

15267.

1900
Literature

E11080

TRIUMPHS IN BIRD-LIFE

BY

CHARLES J. PATTEN,

M.A., M.D., Sc.D.,

PROFESSOR OF ANATOMY, SHEFFIELD UNIVERSITY,

AUTHOR OF

"THE AQUATIC BIRDS OF GREAT BRITAIN AND IRELAND,"

"THE STORY OF THE BIRDS,"

ETC., ETC.

LONDON :

WATTS & CO.,

5 & 6 JOHNSON'S COURT, FLEET STREET, E.C.4

THE FORUM SERIES

(Nos. 2 and 4 are to be had in cloth only.)

- 1.—THE STREAM OF LIFE. By JULIAN S. HUXLEY.
“It would be hard to find a better or more stimulating introduction to the general study of biology.”—*Manch. Guard.*
- 2.—THE RELIGION OF AN ARTIST.
By the Hon. JOHN COLLIER.
“It could hardly be improved.”—*Nation and Athenæum.*
- 3.—MR. BELLOC OBJECTS TO “THE OUTLINE OF HISTORY.” An acute and masterly criticism.
By H. G. WELLS.
- 4.—THE GOODNESS OF GODS. By EDWARD WESTERMARCK.
Dr. Westermarck wields a facile pen, and he has never used it to greater effect than he has done in this delightful work.
- 5.—CONCERNING MAN'S ORIGIN.
By Prof. Sir ARTHUR KEITH.
The Presidential Address to the British Association, 1927 (with additions), and other Essays.
- 6.—THE EARTH: ITS NATURE AND HISTORY.
By EDWARD GREENLY, D.Sc., F.G.S.
“For the beginner in the science of geology it is one of the most useful books yet published.”—*Sheffield Daily Telegraph.*
- 7.—CRAFTSMANSHIP AND SCIENCE.
By Prof. Sir WILLIAM H. BRAGG.
The Presidential Address to the British Association, 1928, with supplementary Essays.
- 8.—DARWINISM AND WHAT IT IMPLIES.
By Prof. Sir ARTHUR KEITH.
Contains the famous Ludwig Mond lecture, dealing with Immortality.
- 9.—WHAT IS EUGENICS? By Major LEONARD DARWIN.
“The book is the best brief answer yet published to the question the title asks.”—*Nation.*
- 10.—THE MEANING OF LIFE, AS SHOWN IN THE PROCESS OF EVOLUTION. By C. E. M. JOAD.
A subtle and powerful exposition of Vitalism.
- 11.—FROM METEORITE TO MAN: The Evolution of the Earth. By Prof. J. W. GREGORY, Sir A. S. WOODWARD, Prof. W. W. WATTS, and Prof. A. C. SEWARD.
- 12.—RELIGION AS A BAR TO PROGRESS.
By CHARLES T. GORHAM.
- 13.—GOD AND MAMMON: THE RELATIONS OF RELIGION AND ECONOMICS. By J. A. HOBSON.
- 14.—TRIUMPHS IN BIRD-LIFE. By Prof. C. J. PATTEN.

FIRST PUBLISHED JUNE, 1931

152

PREFACE

SIX addresses, delivered by wireless, form the basis of these essays. They have been submitted for publication at the request of many listeners, whose appreciative letters I take the opportunity of acknowledging with much gratitude. I have considered it not only expedient to revise the entire manuscript, but also to amplify it to an extent sufficient to render it adequately informative for presentation in book-form.

I feel much indebted to the British Broadcasting Corporation for many invitations extended to me to speak before the microphone on educational subjects, both to schools and the general public.

Some of the topics in the present volume have already received attention in articles which I have contributed to *Discovery*, *The Times*, and *The Manchester Guardian*. With the approval of the proprietors, I have been privileged to incorporate excerpts in the text; not, however, exact quotations, seeing that I re-wrote and revised the same theme, independently and on different occasions.

C. J. PATTEN.

*The University,
Sheffield,
April, 1931.*

5'98.2072

PAT

CONTENTS

CHAPTER I

THE TRIUMPH OF FLIGHT	PAGE 1
---------------------------------	-----------

Twilight in the rustic garden—Observations on the flight of bats—How these volant mammals are handicapped—Evolution and fate of flying-reptiles—Movements of flying-fish—Flight of insects a dominant feature—Avian flight the poetry of motion—The acme of grace and beauty—The wheeling albatross—The hovering humming-bird—The soaring kite—Exquisite wing-maneuvres during periods of leisure—Migration a supreme triumph—Astounding distances covered.

CHAPTER II

THE TRIUMPH OF SONG	11
-------------------------------	----

A midnight rhapsody—Sweet sylvan music—Water-bubble notes—Songs of the babbling brooklet and shimmering leaves—A mellow bugle-call at twilight—Incessant joyous melody—A flowing carol in the blue expanse—Dulcet strains from the hill-side—Merits of bird-song—Burst of melody at the light-house—Anatomy of vocal apparatus in Bird and Man—Purport of bird-song—The evolution of song and its triumph in birds—A picture of a silent world.

CHAPTER III

THE TRIUMPH OF LOVE	22
-------------------------------	----

A nuptial flight—Love's awakening—The sparrow's courtship—Avian temperament—Sex impulse—Courtship elaborate and aesthetic—Female discrimination—Beauty better than battle—Strange antics—The charm of music—Instrumental and vocal—Architects at work—Astute builders—Curious nests—The “nuptial” bower—Taste for the beautiful—Parental care—Mutual aid—Love triumphs in courtship, family-life, and in the social instinct.

CHAPTER IV

THE TRIUMPH OF BEAUTY	31
---------------------------------	----

Our jolly party at the Zoo—Attitudes and display in various birds—Eye-spots or ocelli—Distribution and optical properties—A remarkable upright “shield”—A scintillating “emerald” in a halo of gold—Gladsome sounds of shimmering plumes—Ornamental liveries and the struggle for existence—Beauty in protective colouration—Mimicry of living creatures and of inanimate objects—Mimetic attitudes—Beauty the triumphant hall-mark in the bird-creation.

	PAGE
CHAPTER V	
THE TRIUMPH OF USE	40
Prodigious appetites—Economic value of insectivorous birds —Birds and fruit-crops—The spirit of give and take—A measure of compensation—Economic value of birds-of-prey—An invaluable deterrent—Owls and their quarry—Heavy toll of rats and mice—Birds-of-prey in the Orient—Highly useful scavengers—Dangers of disturbing the balance of Nature—Birds triumphantly useful to Man and other creatures.	
CHAPTER VI	
THE TRIUMPH OF VISION	49
A speck in the blue expanse—The headlong plunge—On the wing at topmost speed—Flashing like a sapphire—A dash through thicket—Focussing the eye in rapid flight—Keen and penetrating sight—How bats avoid obstacles—Vision and emotionalism—Relative values of the physical senses in birds—Courtship swayed by visual impressions—The predominating “eye-brain”—Retentive visual memory—Migrants and landmarks—Likes and dislikes—Imaginative faculty—An exquisite optical instrument—Vision a supreme triumph in the life of the bird—When the curtain falls.	

CHAPTER I

The Triumph of Flight

TWILIGHT IN THE RUSTIC GARDEN

IT was a lovely summer evening when we descended from the verandah and emerged into the open to enjoy the gentle balmy breeze, delicately scented with the new-mown hay. Our pleasure was much enhanced by a stroll in the garden—that quaint, old-fashioned, rustic spot, full of pleasant memories. As the shadows crept up and deepened in the fading twilight, as blossom and foliage became enshrouded in sombre hue, we lifted our eyes, and eagerly watched the aerial excursions of bats. These curious volant mammals were in large numbers, and their movements were swift and adroit. They searched incessantly for insects with undiminished vigour; they darted, twisted, and turned, at topmost speed. We studied their remarkable powers of flight for some time after sundown. We were desirous to learn whether bats occupied their time on the wing in any way other than careering after insects. Our observations afforded evidence that flight served them no other purpose. Their appetites being sated, they seek cover without delay. Some lurk in the crevices of walls; others secrete themselves in thick curtains of ivy which drape the old church-tower and archway—a dull way of spending the long summer days. Moreover, in the cold season of the year, bats of the temperate regions spend their days and nights in a state of continuous torpor. Throughout this long period of profound winter-sleep (hibernation) neither food nor drink is taken. This seems a most unenviable sort of existence.

THE MANNER IN WHICH THE BAT IS HANDICAPPED

In truth, the bat is a curiously specialized mammal which has become handicapped in several directions. It is not adequately equipped for accomplishing protracted migratory flights to far-off southern climes, where it might enjoy the warmth and abundance of food unobtainable in northern latitudes during the winter-season. Nor, indeed, will the machinery of its wings, taken in conjunction with the architecture of its body, permit it to move leisurely through the air, purely for purposes

THE TRIUMPH OF FLIGHT

of recreation. A bat cannot climb like a kite or a lark into the blue expanse; it cannot glide from branch to branch in copse or timbered glade; it cannot race hither and thither on nimble foot, although directly it alights it may creep smartly for a short distance to reach a crevice or other retreat.

EVOLUTION AND FATE OF FLYING-REPTILES

We turn our attention to reptiles. Millions of years ago Nature busied herself in trying the experiment of providing some creatures of this *Order* with extensive expansions of their skins, which served as flying-membranes. There were giants of the *Race* in those days, with a wing-spread of some twenty feet or more; there were also pigmy lizards of frail and elegant form, and yet many others comparable in size to a rook or a large hawk. Once upon a time these flying "Dragons" formed a dominant feature of the reptile world. But they have all died out, except the lizard, *Draco volans*. This elegant, miniature reptile—with its skin expansion attached to greatly elongated ribs—can indulge, however, at most in making immense leaps, its membrane enabling it to glide or parachute swiftly from a branch of a tree or other vantage-point.

THE MOVEMENTS OF FLYING-FISH

On a calm day, flying-fish make short excursions through the air, at a height a little above the surface of the water. They plane swiftly along by the aid of their markedly elongated and expansive front or pectoral fins, which they do not appear to flap. Flying-fish, flying-reptiles, and flying-mammals seem to have scored little or nothing over their non-flying congeners. On the contrary, it would appear that in the keen struggle for existence the ancestors of these aberrant volant forms have been ousted to a considerable extent from their original *natural habitat* on land or in water. Life at its dawn had its abode in water. It was not until countless ages rolled on that it raised itself from the deep and invaded the land. Multifarious forms, more and more complex, arose and developed. In time, living creatures became so abundant, and competition for a foothold became so keen, that some had to betake themselves to the air, while others were obliged to return to the water, the medium of their far-remote ancestors.

THE TIGER TRIUMPHS OVER THE SEAL

Such was the fate, we may surmise, which befell the terrestrial ancestors of seals and walruses—ancestors very likely as predatory as tigers, panthers, and their kin. No one,

however, who has made a study of the above-mentioned marine *Carnivora* would hastily conclude that, in the specialization of their bodily structure—subservient to their aquatic mode of life—they were fully compensated. Here, then, it is evident that the predatory animal which held its own on land decidedly scored in not being hampered along certain lines of development, correlated with specialized structural adaptations. In a word, the tiger has triumphed over the seal !

INSECT-FLIGHT STRIKES A DOMINANT NOTE

Turning our attention to that wonderful class, the insects, we ask whether the acquisition of wings has proved a triumphant feature in their lives. Unhesitatingly we answer in the affirmative. Let us reflect upon the millions and millions of years which have passed since insects first became differentiated from pre-existing invertebrates. Let us reflect upon the remarkable powers of flight which insects not only have acquired, but also retained : powers which at the present day, as throughout the ages, dominate their lives.

WINGS OF INSECTS AND OF VERTEBRATES

It is noteworthy that the wings of insects are appendages which have been evolved *in addition to their locomotory limbs*. Insects are hexapods—that is to say, animals with six limbs, arranged in three successive pairs, none of which has become adapted for flight, all having retained their independence for purposes of locomotion on land or, in some cases, in water. Vertebrate animals (other than mythical) never possess more than four limbs. In the bat and bird, which fly in the true sense, the front-pair have become so highly specialized structurally that they have been wholly transformed into wings. But in the flying-lemur, squirrel, and phalanger, whose excursions in the air are limited to immense leaps, while the limbs are enclosed in an expansive skin-fold, the front-pair are not amplified in any marked manner. Flying-vertebrates, therefore, are not furnished with more appendages in the way of limbs than those possessed by species which are purely terrestrial. It should be noted, furthermore, that the wings of vertebrates are almost exclusively subservient to flight.

Insects as a class—to which, however, there are exceptions—get over the ground with considerable agility. Their wings arise in the form of thin yet tough, highly elastic, membranaceous outgrowths, and, as already indicated, quite independently of the limbs. Indeed, they have from the beginning a very different mode of development. The muscular

THE TRIUMPH OF FLIGHT

machinery is exceedingly powerful, and is so swift in its action that it is not possible, under ordinary circumstances, to detect the individual wing-strokes. Speaking generally, the flight is strong and remarkably rapid. Many insects in darting through the air pursue a straight course for a longer or shorter distance. Hence the popular expression, "*Bee-line*," signifying the typical straight course pursued by the bee. Some wing-movements are highly attractive, especially when the path through the air is frequently and suddenly deflected at a sharp angle. The familiar aerial dance of the gnats, so full of rhythmic rise and fall, cannot fail to arrest attention. Nevertheless, in regard to the wing of the insect, Nature has not assembled machinery sufficiently elaborate to permit of the exquisite grace, beauty, and other fascinating features, which are revealed in an attentive study of avian flight.

THE MACHINERY OF THE BIRD'S WING

Birds are provided with multi-jointed wings. The constitution of the osseous framework is strictly homologous with that of Man and other vertebrates. But in the volant bird the bones are lighter and stronger proportionately ; and the hand, with its fingers (the tip of the wing carrying the pinions) much elongated and narrow, has lost many of its constituent bones, while those persisting have become firmly welded, forming an admirable flail which cuts the air and thereby effectually overcomes the high resistance offered to the powerful down-stroke of the wing. Stupendously powerful muscles, passing out from the body-wall, especially from the pectoral region, to the various segments of the bony-framework, can act upon the intervening joints and in that way produce many and varied movements. The wing, as a whole, can be completely spread : it can be completely folded, so that it occupies a position against the side of the body-wall. The wing can also be elevated to meet and actually make contact with its fellow above the back, while it can also be lowered to touch its fellow beneath the breast. Furthermore, it can be freely rotated backwards and forwards. Several partial movements can also be effected by the action of special muscles on the respective joints. Moreover, the flight-feathers are granted individual movements by fine multiple muscular action ! All this marvellously intricate mechanism is found lacking in the rigidly outstretched membranaceous wing of the insect. True, in some cases folding is not altogether denied, indeed in exceptional cases it has advanced to a remarkable degree, as for instance in the earwig, ladybird, and other beetles. In

such cases the wings are thrown into folds or crimped, comparable to the manner in which the bellows of a concertina or a camera closes up. In flight, however, they are kept fully on the stretch. Moths and butterflies are provided with two pairs of wings, and when these insects alight the front-pair overlap the hind-pair. But obviously the wings are not folded.

The plumage of birds offers a comprehensive study. Feathers, taken collectively, afford protection, and lend an aid in regulating the body-temperature. They are also indispensable adjuncts—more particularly when curiously developed and ornamental—in courtship. The primary use, however, of feathers, great and small, is intimately associated with flight. In this direction it is not surprising to find that their minute structure is highly intricate.

A MASTERLY SPECTACLE

Many aspects of bird-flight provide a masterly spectacle. There is something fascinating in watching a herring-gull sail past on outspread, motionless pinions, against a stiff head-wind, and by skilled and graceful tactics float onward in slow yet progressive flight.

White bird of the tempest—Oh ! beautiful thing—
With the bosom of snow and the motionless wing ;
Now silently poised o'er the war of the main,
Like the spirit of charity brooding o'er pain.

Now, having made an excursion to the sea-coast, let us take a trip in a steamer. The day is delightfully fine and the water calm. We remain on deck for several hours, basking in the brilliant sunshine. As our craft ploughs through the waves our enjoyment increases ; we grow buoyant in spirits at the idea of making some interesting observation, for autumn migration is in full swing. We have been keeping a sharp look-out, and have been rewarded. We are struck with admiration at the determined manner in which a frail-looking, dainty little warbler, scarce larger than a wren, forges ahead over the billows at a speed not inferior to that of our vessel. Who would not be greatly impressed by such wonderful endurance on the wing ?

Having disembarked, we quit the coast, and trek a few miles inland, presently finding ourselves wandering along the edge of a large fresh-water lake. Several species of duck, together with numerous coots, water-hens, and some little grebes—dabchicks in popular parlance—come under our notice at no great distance from the brink. Suddenly, a single highly-pitched note reaches our ears ! All eyes are immediately

THE TRIUMPH OF FLIGHT

directed to the right, whence the sound came, and luckily we catch a momentary glimpse of a kingfisher, whose brilliant plumes (now emerald, now sapphire, according as the light plays upon them) flash like precious jewels as it darts like an arrow across the embankment to a rivulet, round the bend of which it is lost to view. Turning our attention once more to the extensive sheet of fresh-water, we see away in the distance a company of wild swans commencing to rise. We note the slow manner in which these hefty birds appear to get under way. We hear the loud, sharp swishing sound of their beating pinions so clearly that we are reminded forcibly of the cracking of whips. Not many moments, however, elapse before a very different spectacle presents itself : these ponderous water-fowl, now well under way, are masters of the air in flight superb.

Lo ! the wild swans through the firmament swoop
With their gong-throated queen, a beautiful troop :
Wheeling gracefully earthwards, and floating as though
The young winds were wooing fair cloudlets of snow.

THE POETRY OF MOTION

Avian flight may well be called the poetry of motion. From days remote, Man has watched intently the wonder of the wing. Carried away by admiration, he has for centuries exercised his ingenuity in striving to discover the secret by which the air might be conquered. The science of modern aéronautics has borrowed many ideas from the mechanism of avian flight. The studies of the bird on the wing have certainly aided Man in his conquest of the air ; a feat now accomplished ; surely a momentous event ! The speed now reached in aerial travel, and the skill and courage shown in tackling and surmounting difficulties in this thin, invisible medium, are decidedly startling. Aviation is growing more popular every day, and aviators (and indeed the general public) are growing more and more confident. We owe much to those who have been instrumental in establishing aviation on a commercial basis, and we take off our hats to those brave men and women who have traversed thousands of miles alone in their monoplanes. To the bird, its structure, the architecture of its wings, and the mechanism of its flight, our thoughts again turn when contemplating Man's stupendous achievements in aviation.

STABILITY OF THE BIRD IN FLIGHT

Can a bird when flying be capsized ? Turn it on its back and, like a capsized lifeboat, it immediately rights itself. Both

bird and boat turn keel downwards. The shape of the avian body and the distribution of the internal organs are admirably adapted to promote stability during flight. The body moves through the air like a boat through the water, a boat provided with a deep and heavy keel. In the "hold" of the bird's boat-shaped body (formed by the deep or upper surface of the breast-bone, concave in shape) the heavy organs are lodged, while the keel itself is heavily weighted by the enormously-developed breast-muscles which are attached to it and the rest of the under surface of the breast-bone. Such adequate ballast is bound to promote marked stability. The air-sacs and lungs, extremely light in weight, occupy the dorsal part of the bird's body—that is, along the line of the backbone. They correspond in position to the deck of the boat. From the "deck" the wings arise, and obviously, when they are spread out horizontally, the centre of gravity of the "boat" is situated as remote as possible from their suspension, enabling balance to reach its maximum efficiency. In flight, a bird can finely adjust its centre of gravity as required, by various bodily movements, such as backward or forward thrust of the expanded wings; elevation, depression, or rotation of the tail; coiling and stretching of the neck; turning the head; and finally by partially folding one wing to a variable extent whilst the other remains expanded.

NECESSITY OF BODY-WEIGHT

Birds are heavier than air, and body-weight not only is an absolute necessity, but also it is a great asset in the mechanism of flight. It is clear that, without proportionate weight, the momentum which a bird gathers as it proceeds under way could not be sustained. A creature or an inanimate machine, lighter than air, would wander in space uncontrolled. On the other hand, with adequate weight and sufficiently ample wing-surface to gain support from the air, a bird when under way can travel immense distances without fatigue on an air-current of its own making. Speaking generally, flightless animals who locomote swiftly on solid, unyielding ground, present relatively small propelling surfaces which meet with maximum resistance, but occasion minimum displacement. Birds who locomote in a thin, elastic, fluid medium—the air—in order to gain support present very ample propelling surfaces which meet with minimum resistance, but occasion maximum displacement. It is obvious, then, that rapid flapping-flight could be maintained for many hours after rapid trotting on land had been brought to a standstill through sheer fatigue. This fact is made still

more clear when we remember that the muscles of flight are in the aggregate much larger and more powerful than the corresponding muscles of locomotion in mammals, and that a bird, under way, can travel on induced currents without exertion. It has been suggested that the hot air permeating the extensive system of pneumatic sacs reduces the density of the body to so great an extent that the bird rises *ipso facto* after the fashion of a balloon ! Apart from the disadvantage which inadequate weight would cause in the mechanism of flight, it is noteworthy that a bird can accommodate only an insignificant amount of air in its sacs, above what is necessary for normal breathing purposes : hence diminution in the specific gravity of its body can only be regarded as a negligible quantity. When Man first became aware of the fact that, bulk for bulk, a goose, a swan, or a gannet, was as heavy proportionately as a dog, a fox, or other wingless animal, he discovered that he was directing his thoughts on the right track, in endeavouring to plan out the mechanism of a flying-machine which would move through a medium much lighter than itself. He soon learned and appreciated the fact that birds could plane, glide, and wheel, on motionless outstretched pinions, with conservation of muscular energy. Why, therefore, should not an aéroplane be constructed, capable of carrying out the same type of movements ?

Migration the Supreme Triumph of Flight

Already we have seen the triumphant march of flight in the life of the bird. But we still have to refer to the peregrinations of migrants—at times very protracted and fraught with difficulties : here we are presented with the supreme triumph of avian flight. Velocity, doubtless, is very remarkable under certain circumstances, but endurance on the wing stands out as a constant feat far more remarkable. In some birds this faculty is positively astounding. The Arctic tern flies almost from Pole to Pole twice a year. The curlew-sandpiper, when only three months old, migrates from Arctic Siberia to New Zealand. The tiny goldcrest, smallest of European birds, frail in form and weighing but a dram, crosses the North Sea on an inky-dark November night ! The swift can fly from Tropical Africa to the British Isles in seventeen hours. Flight in birds differs widely, according to the form of the wings and their ratio in size and strength to the body. Variations in flight are also closely correlated with variations in habits and conditions of life. The heron is provided with very ample wings and a small body ; consequently the bird is buoyant on the

wing and moves along in a leisurely manner. On the other hand, the grouse has relatively small wings and a large body; consequently this bird is not buoyant and its flight is hurried, its wing-strokes being of necessity delivered very rapidly.

THE WHEELING ALBATROSS

It is in the long-winged and more buoyant species, which spend most of their time on the wing, that we are afforded the opportunity of witnessing the most exquisitely graceful aerial evolutions, which we can say without fear of contradiction characterize flight in all its glory. The wandering albatross, giant bird of the southern oceans, is provided with astonishingly long, narrow wings, which stretch out from the body like two bands of wide ribbon, and yield a spread, from tip to tip, of fourteen feet! Having wielded a few exceedingly powerful strokes, this mighty bird can skim over the surface, sweep to a height and sail, and then of a sudden glide or plane down, all the while moving on motionless pinions for a lengthened period over the watery waste. As we continue to watch we cannot fail to note the superb wheeling movements which etc. and anon are carried out in such a perfect manner, that now the wings are set horizontally to the waves, now at forty-five degrees, now almost perpendicular, like the mast of a ship. This monarch of the air, when once fairly under way, can counteract the force of gravity to such an extent that its moving body, notwithstanding its weight of twenty pounds, becomes, in a large measure, self-supporting.

THE TINY HOVERING HUMMING-BIRD

It is a most interesting fact that the tiniest member of the feathered world—the humming-bird—also possesses very long and narrow wings, the movements of which—equally wonderful—offer a striking contrast. So intensely rapid are the wing-strokes that it is impossible to follow them. The vibrating wings appear so misty and gauze-like that it is only by using an exceedingly rapid lens and plate, and then making an instantaneous exposure, that their outline can be rendered sharp in the photograph. Unlike all other birds, the humming-bird can hover in one spot untiringly in front of a flower. When the tiny creature is thus poised, the rapidity of its quivering pinions produces a musically-toned humming sound.

BIRDS-OF-PREY ON THE WING

Birds-of-prey when not hunting, and having satisfied their hunger, fill us with wonderment and admiration as we behold

them soaring leisurely, in wider and wider circles, until they appear as specks in the blue expanse. In these manœuvres the wings are fully spread, and the attenuated tips of the outer flight-feathers are separated so widely that they resemble fingers spread to their utmost limit. At the same time the tail is usually fanned to a variable extent.

THE ECSTASY OF FLIGHT

Birds do not make use of their wings merely for the purpose of carrying them through the air when searching for food : moreover, they exercise their powers of flight for many purposes other than migration. Strange antics are performed at times by small birds on the wing : witness the fitful, ecstatic flight of the amorous whitethroat during courtship ! See also the skylark carolling rapturously when ascending on fluttering pinions. Indubitably, birds derive full pleasure from their flight performances during intervals of leisure, just as an accomplished dancer or skater thoroughly enjoys practising his favourite pastime. The graces of avian flight inspired John Ruskin to symbolize, in beautiful language, the bird as “ little more than a drift of air brought into form by plumes ; the air is in all its quills, it breathes through its whole frame and flesh, and glows with air in its flying like blown flames. It rests upon the air, subdues it, surpasses it, outraces it—is the air, conscious of itself, conquering itself, ruling itself.”

CHAPTER II

The Triumph of Song

A MIDNIGHT RHAPSODY

IT was a chilly, moonless night in May. The clock of the village church had already struck the hour of midnight, and all was hushed in slumber. Suddenly the silence was broken by the rhapsodic outbursts of a nightingale. The challenge was immediately taken up by a rival, and an exquisitely tuneful antiphonal duet, bubbling with emotion, flooded the night-air. We were most fortunate in hearing the complete song, rendered several times over—a song of the first water, in which both performers participated. We were greatly impressed by such delightful melody, considering that the nightingale's song varies markedly in quality. The whole performance was so exceptionally fine that directly we reached home, and with the theme still fresh in our memories, we jotted down copious notes. Here is a descriptive analysis of the many and diversified phrases which when yoked together built up the complete song.

The long, smooth, opening phrases, somewhat tinged with melancholy, called to mind the sighing of the night-wind's gentle whistle, which here seemed to descend through almost imperceptible gradations of the chromatic scale : these were followed by strains strangely sweet, simulating the whisper of a tiny, bubbling brooklet, or the shimmering of delicate foliage. Next we heard the peerless minstrel liberating *fortissimo* a rapid succession of chattering notes, silver-toned, yet defiant ; subtle as they began to wane ; mystic as they floated away on the night-air ; thrilling as they rolled back—a passionate outburst—with dramatic suddenness upon our ears. The listener, however, is not always granted such a great treat. The music of the brooklet and of the shimmering leaves is often less accentuated ; indeed at times it is swept away by the more rapidly inflowing tide of passionate outburst.

THE BLACKCAP'S SWEET AND SOULFUL MUSIC

The song of the blackcap is much less familiar. This superb vocalist is shy, elusive, and retiring, and will cut short its song on the least suspicion of danger. More often than not we hear mere snatches of its wonderful musical powers.

Nevertheless, these snatches are warblings exquisitely pure and dulcet, which recall the rippling silver-tones of the babbling brooklet. Such is the quavering music that we hear when the blackcap is treading its way through dense and tangled undergrowth in search of food, or when guarding its right of territory. Although these notes so abruptly poured forth are priceless in quality, they convey but a faint idea of the power, sweetness, and purity of the composition which this soulful songster creates when it comes to a standstill and warbles its verses to their full extent. Then the outburst surges passionately into a joyous, rolling, and bubbling melody; loud, piping, and brilliant, yet indescribably rich, sweet, liquid, and mellow in tone. On hearing the complete lyric, we feel sure that several notes, in quality of tone, excel those found in the nightingale's song. Truly, the "water-bubble" rolls of the blackcap are enchanting.

THE GARDEN-WARBLER'S GUSHING STRAINS

The garden-warbler, clothed in a plain drab-brown costume, is closely allied to the blackcap. It requires a practised ear to distinguish the song of the two species. Not only is the music very similar, but owing to individual variation there is a tendency to convergence, indeed overlapping in a certain degree. A first-rate blackcap takes the premier rank, yet a second-grade bird (also an exquisite vocalist) may be beaten in quality of voice by a garden-warbler of the first water. However, taking the average, we find that while the song of both species partakes of the same alluring setting in which we hear the laughing babble of the brooklet, the voice of the garden-warbler is a shade more luscious, liquid, and gushing, but its diminished power, rhythm, and clarity render it certainly less telling than that of the blackcap. Moreover, the garden-warbler sings so hurriedly, and stops its verses so abruptly, that the fine, fluty finish so characteristic of the blackcap's song, falls away or is completely lost. The garden-warbler, like its congener, is very shy; hence more often than not we hear mere snatches of its delightful music.

THE SHIMMERING SONG OF THE WOOD-WARBLER

The song of the wood-warbler has a charm all its own. The verses, towards their termination, are reeled off so rapidly that the quivering, tinkling notes, delicate in tone and volume and high in pitch, closely simulate the soft, refreshing sound of shimmering leaves which is produced by the fanning of a gentle breeze. This bird, in addition, utters at intervals a clear

bell-like note, which may be heard at a considerable distance. Sometimes this note is appended to the shimmering verses at stated intervals, and is repeated from six to a dozen times, but it is rather an irregular performance, and not infrequently altogether omitted.

THE CHANTING CHORUS OF THE WILLOW-WARBLER

The willow-warbler is an abundant species, arriving from southern climes in spring and departing in autumn. The migratory movements of the other warblers above mentioned, follow suit. Some woodland districts resound during May and June with a most expressive chorus of willow-warblers. The chanting of these songsters seems at times to take on a fugal form, thereby rendering their plaintive, silvery-toned melody delightfully pleasing. The shades of expression and the regular rhythm, first waxing, then waning, finally melting into a sweet *pianissimo*, warbling murmur, impart an artistic finish to the performance.

THE BUSTLING OUTBURST OF THE WHITETHROAT

The lively whitethroat is another abundant British summer-bird. The setting of its song somewhat resembles that of the garden-warbler, but its tone is inferior in quality. Its verses are hurried, almost bustling, short, and delivered in snatches. Some notes are mildly strident, but the song, on the whole, is tuneful. In a manner which appears almost frolicsome, the whitethroat shoots into the air from the topmost spray, and, on fluttering wings, pours out in ecstasy snatches of its joyous melody. Down again, with an unexpected suddenness, it pushes forward through thicket and brake, ready to scold, in harsh, jarring accents, the intruder who encroaches on its preserves.

THE QUAINT REEL OF THE GRASSHOPPER-WARBLER

The grasshopper-warbler, yet another small summer-bird, modestly attired in umber-brown, possesses a quaint song, comparable to the stridulations of a grasshopper or to the sound produced by the winding of a fisherman's reel. The length of time in which the trill is kept going without a break is remarkable. I have heard it sustained for forty-five seconds, but twenty-five is the more usual duration. I have been informed, however, that some birds can spin the reel for a minute and a half. With head tilted far back, and with widely-opened beak pointing upwards, the song is "reeled" off without the least exertion! It is difficult as a rule to obtain

a clear view of this warbler, because of its skulking habits. It secretes itself in dense herbage of fen and bogland, but it also makes its way, in lesser numbers, to upland districts, where it may be heard letting off its "reel," when creeping stealthily through gorse, heath, briar, and brake; but whatever locality it frequents it likes to be near water.

THE SEDGE-WARBLER'S LOQUACITY

The sedge-warbler is plentiful in our Isles during the summer months. Like other warblers, it dresses quietly, but it carries a well-defined broad white streak over the eye, which stands out in relief against the umber-brown feathers of the crown of the head. As the name implies, this species resorts to marshy spots. It delights in osier-beds, but it also moves nippingly along the bottom of hedgerows and other thickets. It has a strong, lusty voice, not quite free from harsh, strident notes. *Song*, among its many purports, betokens pugnacity and right of territory. No bird is more readily provoked to challenge than this hot-headed, loquacious little warbler. If we approach its preserves sufficiently close to arouse the least suspicion, or if we drop a scrap of turf or some such harmless missile among the sedges, it immediately showers down wrath upon our heads. The sedge-warbler is a capable mimic. Its varied repertoire consists of songs culled from many species, which it reproduces in rapid succession. With unexpected outbursts the sedge-warbler often breaks the stillness of the night with its strident tones and fussy impersonations, some musical, others rather discordant.

THE BLACKBIRD'S EVENING LYRIC

At this juncture we may ask ourselves:—Which songster scores the highest marks for peculiarly rich, flute-like tones, for rhythm, for regular and measured time, and especially for *motif*?

O Blackbird, what a boy you are !
 How you do go it !
 Blowing your bugle to that one sweet star—
 How you do blow it !
 And does she hear you, Blackbird boy, so far ?
 Or is it wasted breath ?
 " Good Lord ! she is so bright
 To-night ! "
 The Blackbird saith.

In this elegant verse T. E. Brown indulges in no poet's licence. He must have observed accurately the blackbird's crepuscular habits and the manner in which its emotions surge

after sundown. If alarmed before retiring to roost, it is particularly vociferous. On the other hand, it is particularly soulful in song when the stars begin to peep. Doubtless, it was from an enchanting evening lyric that the poet gained his inspiration.

THE JUBILANT RHAPSODY OF THE SONG-THRUSH

The rhapsody of the song-thrush—wild, buoyant, and decisive—expresses the very acme of joy ! With indefatigable energy it dominates the feathered choir. It freely repeats its verses ; borrows from other songsters ; and seems always in the “lime-light”! In early summer the song-thrush, in many instances, will sing for sixteen hours, with only short breaks for feeding-purposes.

THE SKYLARK’S FLOWING CAROL

The wonderful faculty which the skylark possesses of liberating a continuous flow of melody, while on rapidly beating pinions it ascends in spirals to the clouds, seems almost beyond our comprehension. We can appreciate such a marvellous feat of carolling only by studying the anatomy and physiology of the respiratory, vocal, and muscular systems, which in birds have undergone very remarkable development.

THE DULCET LAY OF THE LINNET

The foregoing song-birds have narrow, slender beaks, tapering to a point, and suitable for the capture of insects, worms, and other living creatures, upon which they subsist. In popular parlance they are called “soft-billed” birds. Those which feed on grain and seeds have thick, short, strong, conical beaks. Some of these “hard-billed” birds are noted minstrels. The linnet is a most cheerful companion. We much prefer to hear its rich, chuckling song on the open common or breezy hill-side in which the bird delights, rather than in the aviary, but its lay is welcomed from any spot. The voice is robust, yet one must be near at hand to catch all the delicious, sweet music. Sometimes we have the added pleasure of hearing a duet, a trio, or even a small chorus. The song varies much in quality, in duration, and in strength, but it is always beautifully dulcet. The buoyant, full, rounded, call-note, which may be syllabled *cho-ho*, is also bubbling over with music. It seems to convey a message of encouragement ! The captive linnet, when well cared for and allowed roomy quarters, gives us the impression, from its delightfully pleasing and uplifting utterances, that it is the greatest optimist in existence !

THE GOLDFINCH'S SWEET SOPRANO

The goldfinch is another “hard-billed” bird endowed with a song peculiarly pure and sweet. Its delivery is serene, and, while thin and highly-pitched, it is beautifully liquid—a silver spray of gleeful melody. In fact the song of the goldfinch catches the spirit of the soprano artiste in a most arresting manner. No caged bird is a greater favourite. By its ornamental dress, dainty deportment, sweet voice, and marked docility, it endears itself to our hearts.

THE CHAFFINCH'S BLITHE CAROL

The chaffinch, though one of the lesser lights as a vocalist, is a bright and cheery little soul. Its song is unmistakable : the verses are repeated again and again with extraordinary vigour, and with intervals of only a few seconds. Uniformity in the character of the voice affords the key to its identification. The blithe, joyous carol is poured out at the same speed, at the same pitch, and with the same tone and resilience. Three, four, five, or six words, exactly similar, are followed by three or four different words, all rendered *allegro* in very rapid succession : all forming a melodious and most lively stanza. Here is what the chaffinch says : *ring, ring, ring, ring, rattle, sister, dear, cheerio*. But the song varies in length, while remaining constant in speed, rhythm, and quality. Sometimes the verse is curtailed or abruptly truncated. But when a suffix of fine quality becomes incorporated, the value of the songster goes up by leaps and bounds. I have listened to a chaffinch for some seasons past who sings a fine song with a suffix, “*institutio*,” pronounced with unmistakable clarity. The whole song is a perfect treat to hear.

THE MERITS OF BIRD-SONG

It is not an easy matter to assess the relative merits of bird-song. Much depends upon our individual tastes. Familiarity with the blackbird's music has not lessened our eagerness to hear it often repeated. We warmly welcome our sable friend as he comes forth from cover, and from the branch of a tall tree, from a chimney-pot, or from a flagstaff, opens his gilded beak and blows his bugle to that “one sweet star.” When listening we seem to come into closer fellowship with him than with any other song-bird. The blackbird has a habit of tacking on a short phrase, at times borrowed from another vocalist (song-thrush, robin, chaffinch, and others), or else, and more frequently, a composition of its own. Generally speaking, we do not hear these added verses until the breeding-season is in

full swing. This phrase consists of a few short piping-notes, sounded as though played *allegro* on a flute. They are linked on to the normal deep, mellow, carefully measured "bugle-call." They introduce novelty at the finish of a song which otherwise, though beautiful in quality, lacks variety. The contrast between the music of the blackbird and that of the song-thrush is striking, yet listeners sometimes seem to find a difficulty in distinguishing the two voices. The blackbird sings its verses with quiet enthusiasm : it never hurries or overflows with excitement ; it seems to follow a measured beat. The song-thrush repeats its short phrases jubilantly. Its song is rhapsodical ; that of the blackbird lyrical. The song-thrush is provided with an extensive and varied repertoire in which several unmusical notes can be detected. The blackbird is conservative and has less to say, but in quality its exposition excels that of its congener. Rain stimulates the blackbird's voice ; nor is the imperturbable bugler disconcerted at the wrath of Jupiter ! Amidst the rumblings of thunder the melody is often at its best. We are greatly attracted by the voice of the linnet. All utterances are delightfully sweet : the call-notes no less than the song. Both are so rich, yet so cheery ; so mellow, yet so decidedly robust. If we drop into the heath and bracken for a rest, we are gladdened when we catch the linnet's strains wafted by the upland breeze ; they are as music dedicated to the mountain, music which few upland species contribute.

For want of space the description and merits of the song of several other species must be omitted. Reviewing the voices of those species which I have submitted to analysis, I am of the opinion that the blackcap, notwithstanding its rather limited compass and lack of variety in its exposition, possesses the sweetest voice of all our British birds.

THE PLUMAGE OF SONG-BIRDS

It is noteworthy that our finest songsters, with few exceptions, are small in size and sombre in dress. The nightingale is, for the most part, russet brown ; the garden-warbler drab-brown. The skylark, woodlark, linnet, blackcap, reed-warbler, sedge-warbler, wood-warbler, willow-warbler, blackbird, song-thrush, and others, are quietly attired, showing little or no brightly contrasted colours in the pattern of their plumage. On the other hand, the gaily-plumed goldfinch, chaffinch, redstart, and robin, may be cited as exceptions to the above rule. The largest British song-bird is the missel-thrush ; the smallest the goldcrest. In far-off lands we find a wider

range in size. In Australia, for instance, the piping crow-shrikes, almost as large as our rook, and the lyre-bird, larger still, are gifted with beautifully mellow, flute-like voices.

SINGING INBORN AND COMPULSORY

In birds, singing is an activity, instinctive and compulsory as eating or drinking; differing, however, in being seasonal rather than continuous. When the appropriate season comes round, birds are unconsciously compelled to tune up: they have no choice in the matter. In spring, even in adverse and drear surroundings, the imperturbable minstrels pour out their melodies, many in rapturous and passionate strains. Pent up in cages, with hardly room to turn round, and domiciled in smoke-begrimed atmosphere, the captives sing out with vigour and persistence. The skylark carols joyously when standing upon *the floor of its cage!*

A BURST OF MELODY AT THE LIGHTHOUSE

Not infrequently, birds will burst into song when migrating at night. I have heard, and actually seen, many different species singing as they emerged from the impenetrable gloom in thick, foggy weather, and came under the subtle, almost mesmeric, influence of the dazzling beams of the lighthouse lantern. The question has often been put to me:—Have you not felt lonely when exiled upon a surf-lashed, rock-island light-station? Could a bird-lover feel lonely who, on stretching out his arm over the rails of the balcony, beheld many little feathered travellers readily availing themselves of the perching accommodation offered them! It was indeed a thrilling enough experience to listen to the pretty twitterings of swallows, as the birds rested upon the back of my outstretched hand; but when a goldcrest—finest of all European birds—alighted upon my shoulder and whispered in my ear its tinkling, bell-like ditty, I felt, as I bent down to catch the strains which the roars of the breakers threatened to drown, that no place on earth was more entrancing than a lighthouse on a migration-night.

VOCAL APPARATUS IN BIRD AND MAN

It follows, as a corollary from voice-production in birds being inborn and obligatory, that no tuition is required; in other words, singing is instinctive. Orphan birds, reared in captivity, sing accurately their prescriptive songs. The vocal apparatus, though highly specialized and elaborated, permits of the most perfect vocal results without tuition. In birds, the song-box, technically known as the syrinx, and provided

with a unique arrangement of vibrating membranes, is situated *at the bottom of a long and an elastic windpipe*, the two branches of which, called the bronchi, also participate in its architecture. This arrangement favours the production of rich, mellow, flute-like tones. At the same time the marked elasticity and length of pipe permit of a high degree of resilience. No obstructions along the lengthy windpipe confront the free passage of the outgoing voiced current of air into the open mouth, whence it is wafted into the atmosphere without loss of clarity or volume. Hence it is that bird-music carries a long distance. Birds when singing are never shy, nervous, bashful, or self-conscious. They do not perform to please an audience; they know and care nothing of criticism. They are not concerned as to whether their vocal language gives pleasure or annoyance to other sentient creatures. In Man, the song-box, technically known as the larynx, is situated *at the top of a short windpipe*, the vocal membranes being close to the floor of the mouth. But, despite its short passage, the voiced current of air encounters many obstructions during its exit, to wit—a bulky, fleshy tongue; a drooping soft palate with its pendant uvula; constricted fauces, and not infrequently projecting tonsils; a leaf-like epiglottis; and, in addition, several pharyngeal pockets. Hence Man, whether singing or speaking, has to guard against "throaty," "tight," or other faulty voice-production. The play of the lips, and the application of the tongue to the teeth and palate in the formation of consonants, also require special management. In truth, singing in Man is a fine art, and a successful voice requires careful training and cultivation. Moreover, only some persons are endowed with the faculty of singing, and the quality of the human voice varies in a marked degree. On the contrary, every individual of a given species of song-bird sings, and if the song of some be better than that of others, it is invariably prescriptive and clearly defined.

THE PURPORT OF BIRD-SONG

The song of birds is usually rendered *forte*, and betokens zeal and passion. Though often sweetly melodious, it is not expressive of sympathy. On the contrary, it connotes emulation, rivalry, defiance, and, in a large measure, pugnacity. I have seen two robins singing whilst facing each other on level ground: in a flash they came into close grips, and as suddenly let go: again they closely approached and sang at each other, all the while assuming defiant attitudes. Bird-song is an important feature in courtship. The males, in competing for

the possession of the female, annex their respective territory, within the confines of which they "blow their own trumpets." The female gives heed, and in many cases appears to show preference for certain singers; and there is reason to believe that mating takes place more promptly when the males not only outstrip their rivals in vocal powers, but also surpass them in the zeal and passion of their performance. Some male birds have far greater vocal endurance than others, and the greater the output of song the more likely is courtship to come to a successful head. This corollary concerns only birds in which singing is the dominant feature in courtship.

WHY SONG IS A TRIUMPHANT FEATURE IN BIRD-LIFE

We naturally ask:—Why are birds in particular gifted with all this musical language? Can we account for the development of song which in bird-life has culminated so triumphantly? Here is the answer put in a nutshell: the triumph of song has developed as a necessary sequence to the triumph of flight. We have seen that birds are not creatures who are granted the powers of flight solely to enable them to capture their quarry on the wing and then to retire into seclusion. Birds are aërial creatures in leisured intervals no less than when actively seeking food. They can flit from branch to branch, drop to earth and shoot up into the air repeatedly with ease and rapidity. They can soar, plane, and glide, on motionless pinions. Their endurance on the wing is astounding; we note it when birds are migrating. The whitethroat, in fits of ecstatic flight and song, can court on "wings of love." The skylark, ascending on fluttering pinions, takes his joyous carol to "Heaven's Gates." Figuratively speaking, birds have become the "children of the air," resting on it, subduing it, surpassing it, outracing it.

A REMARKABLE TRANSFIGURATION

Of a truth, when avian flight reached such a pitch of triumph, a new era in the annals of evolution—namely, Bird-Language—became established. As the dawn of avian life burst into sunlight, a wonderful transfiguration followed. From the cold, taciturn, reptilian-like ancestor, beautiful and fascinating forms emerged—hot-blooded, bubbling over with vitality, vivacious to the highest pitch. Could they—charming birds—express their emotions silently? Surely not: their keen responsiveness soon manifested itself in the development of alarm-notes, harsh battle-cries, call-notes, and song. *Pari passu*, the vocal machinery grew markedly elaborate and extremely efficient.

Sociability, amounting in many species to a very definite comradeship, is an outstanding feature of bird-life; indeed, without the power of producing varied and far-reaching utterances, birds would not have been able to maintain with efficiency their code of society. Except in a minority of species, it was incumbent that loquacity should become assertive, and this feature certainly shows itself in the incessant verbal enquiries, vocal messages, and other chatterings of many species, especially among the highest *Orders*, which include familiar garden-birds. Musical sounds carry a long way, and their use is of extreme importance in enabling birds, when travelling rapidly through the air, to keep in touch; otherwise they might easily become separated to a dangerous extent. We perceive, therefore, the very close inter-relationship between song and flight. Had the latter not reached the highest pitch of perfection, had birds not become true "children of the air," song would not have played a dominant part; it would not have proved itself a pre-eminently triumphant feature in bird-life.

A WORLD WITHOUT BIRDS

Millions of years ago the world was without birds. It is a strange picture to conjure up in one's mind. It is also strange to contemplate on the songless epoch immediately preceding the appearance of birds, with its weird reptilian creatures, inhabitants of the air, earth, and water—many of them fearsome-looking monsters, colossal in size—yet whose powers of vocal utterance were represented by nothing more than menacing hisses, grunts, and snorts. The conditions of life on our planet at the present day are, happily, very different. Throngs of feathered choristers pour forth their gladsome melodies. In spring, when song has reached its climax, "gentle music melts on every spray." Birds preceded the advent of Man by many millions of years. We rejoice that these fascinating creatures have held their own so successfully, and that species have spread and multiplied. We rejoice exceedingly that birds are now our contemporaries in life.

CHAPTER III

The Triumph of Love

A NUPTIAL FLIGHT

ONE mild, sunny day in early March we were much interested in watching the cunning tactics of a cat. Instead of gliding stealthily, the hunter rushed headlong into the privet hedge, and was within an ace of having one out of a number of excited, chattering sparrows. The birds were so intent on their mission that they were oblivious of the enemy's presence. The cat certainly showed considerable perspicacity in seizing the opportune moment to dash openly and without hesitation at her unsuspecting prey. However, the house-dog arrived on the scene in the nick of time, and so the sparrow's life was saved. Many of us have witnessed these noisy gatherings of sparrows. What do they signify? The female at the moment is in great request. When she ventures into the open and flits across the lawn, a male, then another, presently several others, are attracted by her presence. In winter, when engaged in her daily routine, looking after her own interests, the males remain unconcerned about her movements, although they do not treat her inconsiderately. Certain attentions, however, associated with courtship, some quite enticing, pleading, and gallant, lie dormant, wrapped in winter's slumber.

LOVE'S AWAKENING

Spring now approaches, and Love awakens. Away go the ardent males in their nuptial flight after the female, whom they pursue into the bush. It is worth listening to the conversation which takes place. We detect nothing orderly; the males expostulate incessantly, all the while jostling and sparring—quite a riotous uproar. We fear it is beyond our ken to transcribe the gesticulative language. We can make out, however, that they all say the same words, which are repeated over and over again. Moreover, we note, by their manners and deportment, that their addresses are all meant for the edification of the solitary female whom they have surrounded. Only a few moments elapse, and away go the party again like

hare and hounds. Some of the "hounds," however, drop out, and in the next bush the uproar has become considerably subdued. Off go the party once more to another bush; many other males drop out, and the chattering has almost died down. The female, no longer jostled by the crowd, plucks up courage, assumes a coy yet somewhat perky attitude, stays her flight, and resolves to receive the attentions of one or two of the suitors. In placid pose she watches with a discriminative glance the rivals entering into combat. After a few short encounters, in which feathers are sent flying but no serious injuries are inflicted, the defeated competitor withdraws and flits away. The victor, now finding himself alone with his "lady-love," prepares to "pop the question."

THE SPARROW'S COURTSHIP

How many students of bird-life have carefully watched the familiar house-sparrow making love? It is an entertaining spectacle, and an object-lesson. Dressed in smart nuptial garb, with tail erect and fanned, throat distended, and wings drooped, he bounces about in an airy fashion, now advancing, now retreating, as he playfully parries the "blows" of his expectant spouse. Persisting in his ardent attentions, he looks a silly, soft-hearted old thing, enduring a series of prolonged snubs and peckings before ultimately winning his way. The pleasing subtlety of his whole performance; his persuasive rather than coercive measures; his sedulous display of plumage; his vanity of deportment; his dancing antics; his pleading lyric—all these delightful charms earn for him, as he plights his troth, the name of a gallant little gentleman, who, after clash of arms with his rival suitor, shows good-will. His expectant mate is discriminative. She often appears to exercise a considerable degree of choice—indeed, sometimes she is quite fastidious—before venturing on wedlock. These pleasing and aesthetic features, so characteristic in avian courtship, are associated intimately with remarkable anatomical and physiological developments. We have learned that birds, as they emerged in the countless ages of the past from a common ancestry with reptiles, branched off widely from their cold-blooded cousins. Hence, reptiles and birds have become strikingly dissimilar in many respects.

LIFE'S FIRE ALL AGLOW

Birds have become highly specialized. Their blood is peculiarly rich in oxygen, and considerably hotter than the blood of mammals. Their body-temperature ranges from

104° to 110° (Fahrenheit). In Man, and in mammals generally, the body-temperature in health registers only 98·4° (Fahrenheit). At a temperature of 106° Man would be in raging fever, and he would become delirious, and death would supervene before 110° were reached.

In birds, circulation, respiration, digestion, and excretion, are extremely active physiological processes. Life is as a fire all aglow ; combustion proceeds so rapidly that food must be taken very frequently and in large quantities. The mechanism of the vocal apparatus has reached the acme of development : it is more elaborate and intricate than in that of any other class of animal. In temperament, therefore, we should expect to find birds—particularly the higher types—curiously vivacious, highly emotional, decidedly loquacious, and strangely amorous. These distinctive qualities are manifested in all vital functions, and emphatically so in regard to the sex impulse. Moreover, the love-ceremonial, from start to finish, is with many birds æsthetic, highly elaborate, and prolonged.

FEMALE DISCRIMINATION

Female birds seem to have an æsthetic sense, at least in a general way, which readily reacts to impressive stimulations induced by the male during courtship. But the taste for the beautiful may differ widely in Bird and Man. For example, do the glaring colours and pronounced turgidity which form such striking features in the wattles of the courting turkey-cock appeal to our sense of beauty ? Fleshy, facial appendages in fowls and other birds are certainly not prepossessing “ornaments” according to our æsthetic standard. We have strong reasons for believing that colours arrest the attention of female birds, and as a rule prove attractive. At times, however, the colour-sense seems to become over sensitive, and the birds then grow distinctly crotchety : some shades seem to please them ; others to irritate. Captive birds are prone to take curious likes and dislikes. At one time I possessed a female bullfinch who was partial to red, grey, and brown. She kept on friendly terms with sparrows, linnets, redpolls, and particularly with a corn-bunting. She had an antipathy for green, bright yellow, and white. She held herself aloof from the proffered friendships of a male siskin and a yellow bunting ; the white bar in the wing of a chaffinch invoked displeasure, while budgerigars and canaries made her quite cross ! On the other hand, inmates of the aviary whose colours contrasted strongly have been known to attract each other. Therefore, though it may be difficult to account for

such opposite types of mentality, it remains a fact that birds are endowed with the faculty of discrimination.

BEAUTY BETTER THAN BATTLE

It is much more likely that the female, during courtship, is impressed by the general effects of the colours presented by the male than by analytical details. Indubitably, she pays the closest attention to the careful and proper display of his plumes or other "ornaments." It sometimes happens that an exceptionally beautiful, vigorous male is speedily selected, even though he may not have been victorious in "battle" with his rivals. It seems quite clear that the endowment of beautiful plumage and other adornments, coupled with their careful display, must be of great service to the male when he sets out to woo the female. Indeed, it may be aptly remarked that sometimes in courtship beauty is better than battle!

"GLADIATORIAL" TOURNAMENTS

In species which engage in fierce "gladiatorial" tournaments the female takes up her position close by the "arena," where she eagerly watches the furious combats of the males. But with many birds the tussles are not harmful. The highly quarrelsome, polygamous ruffs, for instance, engage in a pantomimic kind of sparring. Nevertheless, the combatants, with their lowered heads and erected neck-frills (resembling protective shields), look decidedly menacing; and no doubt in all phases of fierce opposition the onlooking female would—if able to express herself in human language—endorse our sentiments that "none but the brave deserve the fair"! At "tournaments," in which love-antics and dances strike a particularly dominant note in the rôle of courtship, the "lady" looks on intently, betraying a serious scrutinizing gaze, at what seems to us a highly ludicrous spectacle!

THE ANTICS OF A COURTING BLACKCOCK

Certainly the attitudes into which the males of some species can throw themselves when courting are astonishingly amusing. The blackcock, a fine, handsome game-bird, rapidly alters his deportment from pomp and dignity to one of pitiful humility. With uplifted head and strained neck, with feathers erect and wings spread, with tail vertical and fanned, he bounces and struts, now to the right, now to the left, now in a circle. Suddenly, without a moment's warning, he prostrates himself, and actually presses his chin firmly on the ground. At the same moment he beats his wings forcibly, whilst rotating his

body to and fro in half circles. In practising these weird antics he gathers up speed, until presently his whole being appears frantically excited.

When other males appear on the scene these supplications are interrupted, and sparring begins, which is often more pretentious than serious, and, in conjunction with display, is carried on intermittently for several weeks. By all these activities the attention of the female is arrested, and in due time she becomes charmed and subjugated. In the case of the polygamous blackcock, several females appear on the scene, awaiting the cessation of hostilities. Eventually, when the vanquished males are driven off, the victorious warriors are received favourably by their numerous wives.

COURTSHIP OF HERON AND WHITETHROAT CONTRASTED

Some birds remain relatively placid during courtship. The heron, for instance, parades to and fro on his long legs in front of the female in what we would consider a stately and pompous fashion. His manners of courting offer a sharp contrast to the ecstatic aerial flutters of the whitethroat and some other small sylvan birds.

THE CHARM OF MUSIC

Music—adopting the term in a very elastic sense, and here signifying any form of sounds which are produced to arrest the attention of the females during courtship—plays a wide and varied part. It is distinguished as “instrumental” when not rendered by means of the vocal apparatus. For instance, the peacock, with “train” erect and fully fanned, produces “music” by rattling his quills; the turkey-cock produces buzzing “music” by scraping the ground with his wings. The snipe, in rapid descending flight, elicits a “drumming,” “bleating,” or “neighing” type of “music.” The outermost pair of tail-feathers, with markedly thickened and curved shafts, and with firm and wide webbing, are spread well apart from the rest of the tail, and as they are much more highly resistant to the rush of air, flowing under the wings during the bird’s descent, they constitute the musical instrument.

Vocal “music”—also adopting the term in an elastic sense, seeing that some notes are far from being musical in quality—is a much more dominant feature; indeed it plays an important part in the rôle of courtship. Vocal “music” is produced in a crude form by distension of air-pouches appended to the throat. They vary considerably in size, form, and structure, and are found in the prairie-grouse, umbrella-bird, bustard,

emeu, and some other species. The vocal "music"—deep, hollow, booming notes—produced by birds possessing these curious air-reservoirs acts as an accompaniment to strangely grotesque attitudes, dances, and love-antics, together with plumage and other decorative displays.

MELODY IN COURTSHIP

Melody, however, in the true sense of the term, has supplanted these weird activities to a considerable extent. Song-birds form a very large class, among which may be specially mentioned a great many species of dainty little warblers, whose decorative plumage is subdued, but whose song has reached a delightfully sweet pitch. It would be difficult not to believe that this melody, so passionately poured forth by the wooing males, spreads a subtle charm over the impressionable females. Nay, more; where song almost eclipses other and cruder performances in courtship, there is ample evidence to show that it is not only beauty of melody, but also beauty of exposition and elegance of deportment, which serve in a large measure to influence the female in making her choice of a mate. In my own aviaries I often observed female birds listening with rapt attention to the passionate strains of the males—strains which bubbled over almost with suffocating emotion at the zenith of courtship. Repeated observations upon captive song-birds have led me to believe that superiority in melody, without further attractive qualities, seldom (if ever) won the day. The female almost invariably mated most readily with an all-round first-rate performer, one who proved himself full of vigour, passion, and tenacity. Aviculturists place a very high market-value upon this type of bird.

THE ARCHITECTS AT WORK

When the birds have first mated they move along quietly and discreetly in search of some suitable nesting-site. Presently they become fully occupied in building operations, but they also manage to find time to engage in a little bit of "billing and cooing," and in other dainty modes of love-making. It is most engaging to watch the "cradle" being constructed by such an affectionate couple. The work is completed in a very short time, and egg-laying follows without delay. Some birds convey to us the idea that—consciously or not—they are inspired with a taste for the "beautiful"! We are all familiar with the charmingly neat way in which the chaffinch and the long-tailed titmouse decorate the outside of their nests profusely with lichens. Sometimes a few scraps

of bark, paper, and petals of small flowers are added ; the general effect being always decidedly pleasing. We wonder to what extent the architects are conscious of their beautiful work of art ! We do know, from direct observation, that they devote much time and attention to the finishing touch, in order not only that the decorative material should be tidily applied, but also that it should have a firm attachment to the underlying mosses and grasses : in other words, to the foundation of the nest.

CRAFTY CONSTRUCTION OF CURIOUS NESTS

Birds are sometimes led to alter the architecture of their nests. Fluctuations from type within limits are not uncommon. Pronounced variations, rendering recognition somewhat difficult (when the contents of the nest, the surroundings, and the parent-birds have not been observed), are of much rarer occurrence. In most cases the variation points to necessary adaptation. The birds rise to the occasion, and in feeling their way profit by experience. In other instances it is not always possible to offer an explanation. A few examples may here be cited. The wide-spreading branches of an unkempt hawthorn hedgerow had furnished for several years a favourite nesting-site for chaffinches and other species. Here and there the continuity of the hawthorn was interrupted by holly-bushes. One year the entire hedge was closely shorn of its branches. Several other hedges and shrubberies in the neighbourhood were similarly treated. Most of the birds moved off in search of new building-sites. One pair of chaffinches, presumably unwilling to budge, elected to build upon a flat surface of a holly-stem, representing a stump from which a stout branch had been sawn off. This flat surface took the place of the bottom of the typical nest, which everyone knows is cup-shaped. In other words, the bottom of the cup was altogether omitted. The crafty builders had the good sense to spread an extra thick carpet of wool and feathers upon the face of the hard, bare holly-stump. Once upon a time I discovered a very curious wren's nest. It was cup-shaped, with quite an open top. In this direction it departed widely from the usual large oval form, representing a receptacle completely closed except for the small entrance-hole in the side. The nest was built in the recess of a turf-bank, and an overhanging ledge of the peaty soil served as the dome. Between this canopy and the rim of the nest the birds gained entrance. Here, as in the case of the chaffinches, the cunning little builders adapted themselves to their surroundings and

profited by their novel experience in architecture. On another occasion I found a wren's nest in a roomy recess in a wall. The entrance hole was small, rendering the sitting-bird safe from the invasion of cat, rat, stoat, or hedgehog. The constituents of the nest were a profuse collection of feathers, hairs, and wool; in other words, exclusively lining-material. There was no need for a foundation of mosses and grass-stems in this secure and snug little rock-cavern! Here is a third example demonstrating the deft manner in which birds can manage to adapt themselves to their surroundings.

SOME GENERAL PROBLEMS REGARDING NEST-CONSTRUCTION

In regard to some individuals of a given species which line their nests, and others which omit to do so, the problem grows difficult. I have discovered several nests of the house-sparrow in which the usual liberal lining of feathers, wool, bits of paper, fur, rags, etc., was altogether absent; I have also discovered nests of the reed-bunting which did not contain a trace of the hairs of horses or cattle. Some lapwings lay their eggs in a bare, irregular depression—for instance, in the footprint made by a cow in swampy soil; other lapwings scrape a hole for themselves; while others go further and line the nest with stems of withered grasses. Such birds, however, are in the minority. Even aquatic species, which deposit their eggs on the bare shingle or sand, at times line the slight hollow with fragments of shells and minute pebbles.

AN ARTISTIC "NUPTIAL" PORCH

In returning more particularly to the question regarding taste for the "beautiful," it is helpful to consider the quaint habits of the Australian bower-birds, as exemplified in the breeding-season. These birds design and erect an edifice quite unique, known as the "bower," or "nuptial" porch. It is, without exaggeration, the embodiment of beauty and art! It should be borne in mind that it is not the nest. Bower-birds build in trees. Their "porch" or "bower" is built on the ground. This wonderfully attractive and roomy structure may measure four feet in length, and it may stand two feet in height. Round stones are utilized to maintain the grass-stems in position, and gaily-coloured ornamental material, such as the pretty blue and green feathers of parrots, delicately tinted shells, and bleached bones, are collected and neatly arranged by the architects. The male, when courting, races round this "tent of love," popping in by one door and out by another. He may be observed holding in his beak one

or two bright-looking objects. Suddenly he drops them, and off he goes for a smart little run, snatching up *en route* an ornament, which he presents in a winsome manner to the female. This performance is indulged in several times, the chief part of the game being to drop suddenly the decorative object and as suddenly to pick it up while he is performing, at the same time, various other love-antics in a charmingly playful manner.

LOVE TRIUMPHANT IN FAMILY-LIFE

Lastly, we note with great interest the fond parental care which birds, as a class, exhibit. Practically all day long, male and female cater for their offspring. Instances are on record, many of which have come under my personal notice, where brothers and sisters of earlier broods revisited their old homes for the purpose of helping to provide for their infant relatives. Cases are also on record in which birds have tended their companions, stricken with blindness and other infirmities. We cannot but feel touched by the sympathy which gulls and terns show when one of their party has been wounded and struggles frantically to rise from the water. The members of the flock fly gently to and fro, now and again sweeping to the surface as though encouraging the cripple to take wing. Intrepid indeed are the methods employed by birds of many species in thwarting the common enemy. Let the hawk appear in rapid, swooping flight; let the crouching, sneaking cat come from out the hedgerow with the glare of hunger in its flashing orbs, then the air becomes filled with alarm-notes, and battle-cries, of blackbirds, thrushes, finches, titmice, and others, all of whom will confront and assail the feathered brigand on the wing, or will dash down and mob the prowling feline. Many more ways and means by which birds afford mutual aid are known, but it would be outside the scope of this little volume to enlarge upon the subject. Summing up, surely it may be seen that Love—charmingly pleasing and æsthetic in its association with courtship, affectionate in its association with family-life, benevolent in its association with social instincts—beyond all question, has proved itself a signally triumphant factor in the fascinating life-history of the feathered world.

CHAPTER IV

The Triumph of Beauty

OUR JOLLY PARTY AT THE ZOO

BIRDS look their best in the Spring. The adults have then assumed their nuptial dress, and many species are adorned with special plumes and other fineries. These decorations—which are discarded when the breeding-season is over—offer an interesting study. One day, towards the end of April, we formed a jolly party, including many juveniles, all keen bird-students. We made the Zoo our rendezvous because we wished to learn all that we could about beautiful plumes and other decorations, not only in wild, native species, but also in captives from foreign lands. At the outset we were much interested (especially our young folk) at the deliberate way in which a peacock erected and fanned his magnificent “train” in the absence of his expectant mate! We ascertained that such a procedure was not unusual among individual birds who had grown particularly tame and accustomed to the society of Man. We heard of a peacock who formed an attachment in a farmstead for a pig, before whom he frequently displayed.

DECORATIONS AND DISPLAY

In many species the plumage, apart from the grandeur of its colours and pattern, is rendered markedly decorative through amplification, both in form and distribution of feathers. The resulting liveries are strangely polymorphic, nor are they confined to a particular region of the body. Thus, head-crests; elongated, wavy, filamentous neck-plumes; tufts; tippets; erectile circular frills; hypertrophy in the length of tail and quill-feathers, with curious variations in shape, texture, and axis of growth; are all well-known examples. In addition to plumes, the decorations may take on the form of fleshy combs; wattles; osseous protuberances; curiously-shaped and highly-coloured beaks; as well as vividly-tinted naked patches of the skin in the region of the head and neck. In many species the females are without ornamentation, and their dress is sombre and very dissimilar in shade and pattern to that of the male. Such dimorphism is pronounced in the peacock, blackcock, in many humming-birds, and birds-of-paradise.

In other species the female is decorated, but in a lesser degree than the male. Lastly, there are great numbers of birds in diverse classes in which the sexes are alike, some conspicuous in their gay and strongly contrasted shades; others easily overlooked, their subdued monochrome costumes in greys and browns closely harmonizing with the surroundings. But in all cases the male displays or shows off his dress before the female, varying his performance according to the distribution and pattern of his adornments. Display by the female is exceptional, although there are some species in which she takes the active part in courtship. The painted snipe, the grey and red-necked phalaropes, and certain Australian and Indian quails afford examples; in these species the plumage of the female is more attractive than that of the male. Speaking generally, display plays an important part in courtship, especially in male birds which have acquired strikingly vivid and diversified adornments. The more excited and persistent the male becomes when showing off, the more he is likely to induce the female to mate, and she is probably stimulated still further by adornments of exceptional beauty and perfection, which are invariably displayed in the most advantageous manner.

ATTITUDE OF THE COURTING PEACOCK

Let us turn again to the proud peacock now displaying to his fullest extent—a most impressive spectacle. Having slowly and majestically approached the female, he proceeds without hurry to erect and fan his immensely elongated and gorgeous tail-coverts, which appear to arise as a grand screen or shield from the middle of his back, and to gain support behind from the tail-feathers, which are short, stiff, and dull in colour. The screen is carried so far forward that the wings take up a position altogether behind it, and are occluded from the front view. As a preliminary measure the enamoured bird struts back a few paces and presents the reverse side of the “picture”—an immense shield scaffolded by short, stiff tail-feathers, below which the wings, with partially traillied quills, are completely visible; the whole a dull, drab monotone. Suddenly the right side of the “canvas” is rotated, so that, in all its resplendent glory, it exactly faces the female. At that moment the peacock utters a short, discordant scream, which is accompanied and followed by pleasing tones simulating the shimmering of leaves—instrumental love-music produced by the rapid quivering of the gorgeous train in which thousands of “eyes” now laugh and sparkle, signally enhancing the im-

pressiveness of the entire presentation. This magnificent display not only reveals the unique beauty of the ocellated plumes, but it also forms an exquisite background which harmoniously blends with throat and breast of superbly rich azure blue. A close inspection of a single "ocellus" reveals one of the most lovely objects in existence. The iridescent blue centre is of such a rare, rich, and intensely pleasing shade that it cannot be surpassed in Art or in Nature. This glorious sapphire-like impress is encircled by a most brilliant emerald ring, outside of which there is a warm, copper-coloured band, girdled by five narrow iridescent zones which exhibit a play of colours in slightly graduated shades. The peacock, in the attitude which he assumes when courting, displays his ornate deep blue throat and breast, as well as his gorgeous ocellated tail-coverts, to the full gaze of his expectant partner. Furthermore, his head, in homage bowed, is adorned with exquisitely delicate and graceful filamentous plumes. They remind us of a wisp of slender grass-stems terminating in pretty tufts or inflorescences. These plumes, which constitute a dainty, tremulous ornament, also embellish the head of the female, being the only decoration with which she is endowed. It is similar in the two sexes, and is worn throughout the year. It seems as though it were not a specialization of sexual selection, and was developed in the male long before his magnificent "train" reached the zenith of its glory. It is a matter of considerable interest to learn that the wings are not unfurled for purposes of display. On the contrary, they are kept well in the background, totally behind the screen, and folded, except the quills, which are partially trailed. Likewise the tail-feathers are hidden from view. The reason is obvious. Both these sets of plumes stand in marked contrast to those of the rest of the body. They are not decorative, and therefore it would serve the peacock no useful purpose in courtship were he to open and display his wings in front of the female. A patch of earth would attract as much attention!

ATTITUDE OF THE COURTING PEACOCK-PHEASANT

Next, we may investigate the plumage of the peacock-pheasant, and its correlation with the attitude assumed by the male in courtship. In this species (occupying the adjoining enclosure) we note that the wings and tail of the male are highly decorative. They are bedecked with alluring ocelli. But the throat and breast are dull and devoid of pattern. Therefore, to display his finery most advantageously the peacock-pheasant assumes a different attitude from that of

the peacock. On approaching the female he stands sideways and proceeds to erect and spread his tail obliquely. At the same time he opens his wings, the one alongside the female being displayed usually at a lower level than its fellow. By assuming this attitude, it is quite obvious that the ocelli, according to their distribution, are shown to the greatest advantage. Indeed, the male appears as though he were wrapped in a mantle of sparkling eyes ! If the female attempts to turn to the opposite side, the mantle is swung round in a twinkle, so that it is impossible for her to escape its seductive influence. Sometimes, however, the male crouches so close to the ground that he hides his dull breast, and can then display exactly in front of the female with wings evenly raised and spread, and tail erected and well-fanned. Rapid movements of his head—a constant feature—render the performance still more effective.

ATTITUDE OF THE COURTING ARGUS PHEASANT

We advance a few paces, and a group of Argus pheasants comes into view. Here again it may be observed that the methods of display and the attitudes assumed by the male during courtship are correlated with certain well-defined features in the plumage, and in particular with the unique characters and distribution of the ocelli. The male Argus pheasant is not brilliantly coloured, but his wings are highly decorative. His dress therefore contrasts with that of the peacock. The decorations, however, are hidden when he saunters leisurely with folded wings. In that guise he attracts little attention. But we observe that the attitude which he assumes in showing off before the female, is astonishingly interesting. The crouching bird appears as though hiding behind a large upright shield which projects well in front of the body. This singular ambuscade is formed by the wings, which are erected and fully spread. The head and neck are inclined to one side and well lowered, so that they may be concealed by the shield. The tail is raised and fanned. The male displays sideways to the female, after the mode adopted by the peacock-pheasant ; but since the Argus pheasant hides his head behind the shield, it is necessary that a peep-hole be provided to permit the amorous fellow an opportunity of watching the demeanour of his expectant mate. To attain this end, he either pushes his head for a short distance through a gap between two of the long feathers of the wing, or else he peeps under the margin of the shield. In this attitude the singularly ample dimensions of the secondary wing-feathers are very noticeable ; in the

female they are not unusually developed. Ocelli, arranged in rows of a score or more on each secondary wing-feather, constitute the characteristic ornaments. These ocellated feathers are striped and spotted, making an elegant, well-covered pattern. The quills are also decorative, yet the shades are not vivid, being chestnut-brown with numerous dark zones, which in turn enclose a few black spots. Lying alongside the shaft of each quill there is an area which is shaped so as to resemble a second feather set within the feather itself. This area is paler than the general ground-shade, and is profusely studded with very small brown spots. All these impressive decorations on both secondary feathers and quills are screened from view when the wings are completely folded.

OPTICAL PROPERTIES OF OCCELLI

Although the ocelli on the wing-feathers of the Argus pheasant are not brilliantly coloured, they at once arrest attention. They are shaded in such soft and harmonious gradations that, when the light falls on them from above (when the wings are fully spread and erected for display), they resemble highly-polished spheres, lying freely within their sockets—in truth, magic, moving “ball-and-socket” ornaments! They measure, each on an average, one inch in diameter. Collectively, they stand out large and conspicuous, viewed from any angle. But they possess distinct optical properties, for when the light falls full-face on them (when the wings are spread horizontally), they look flat, without perspective or stereoscopic effect. To see them “rolling” in their sockets, as though fully “alive,” the light must strike them at an upper angle. The ground-colour of the plumes bearing these unique ornamentations is whitish, striped and spotted with brownish-black. The ocelli are set in single file on each feather, and follow the long axis from base to tip. The absence of gorgeously brilliant coloration in the dress of the male Argus pheasant is more than fully compensated by the endowment of singularly ample wing-plumes most exquisitely and elaborately adorned. The female is destitute of such alluring livery. A keen sense of admiration and responsiveness surely must awaken in her mind when she beholds the enamoured male unfurling his huge ocellated “flag”—a glorious *insignia* of passionate love-making!

ORNAMENTAL DRESS OF THE BIRDS-OF-PARADISE

Time is nearly up, but we have still a moment to take a glance at the amazing dresses of the birds-of-paradise. In

some species these adornments spring immediately from beneath the wings. They are composed of a collection of extensive tufts of fine, often wavy, brilliant feathers, capable of being fanned or erected into shields; when carried pendant they form long trains. The middle feathers of the tail are frequently very much elongated, attenuated, and spirally twisted, and, being shaded in brilliant blue metallic tints, they bear a close resemblance to wires. In other species exquisite decorative plumes arise from the head in the shape of lengthy filamentous shafts or "wires," each "wire" terminating in a surprisingly elegant miniature fan! Whenever the bird grows excited it erects these dainty "wires" and sets the little fans vibrating. Again, magnificent "shields" in gorgeous hues—some remarkable for their colossal size—spring from the throat, breast, nape, or shoulders. Some species are furnished with two "shields," one having its origin from the back of the neck, the other from the breast. Birds-of-paradise, beyond doubt, are creatures of exceeding beauty, not only in the profuseness and coloration, but also in the texture of their plumes: a texture which neither plush nor velvet-pile has ever surpassed in quality. In the metallic lustre of some feathers, birds-of-paradise stand unrivalled. The females are denied these gorgeous liveries, and are usually quite modestly attired. In several species the sexes are curiously dissimilar. As a rule, the wider the difference, the less conspicuous are the females.

A SCINTILLATING EMERALD IN A HALO OF GOLD

The long, soft, golden plumes which grow in great profusion from beneath the wings of the great bird-of-paradise can be erected and made to vibrate; consequently, when the bird throws back its head and exposes its brilliant metallic-green throat and chin, the latter reveals itself as a scintillating precious jewel—an "emerald" encompassed by a "halo" of gold. During courtship the wings are uplifted, the head is lowered, and the neck extended. The long golden plumes are raised and spread to such an extent that the crouching bird appears o'er-shadowed by two softly waving fans of golden-brown: fans with elongated, hair-like, shimmering tips! These fans are the "halo" of gold, in truth a zone of golden glory, in the centre of which the lustrous brilliant emerald throat scintillates like a precious stone! The great bird-of-paradise, when paying court to his mate in his characteristic attitude, presents a spectacle beautiful beyond description.

GLADSONE SOUNDS OF SHIMMERING PLUMES

When parties of these birds assemble on a tree, and start their magnificent plumes vibrating, a gladsome musical sound is produced; as though delicate foliage were set shimmering by gentle puffs of wind, or as though fine fountain-spray played upon the tranquil water of an ornamental pond! Besides birds-of-paradise there are other representative types, the males of which are adorned with neck-frills that can be erected and fanned. The superbly attired golden and Amherst pheasants possess a graceful cape of elongated and brilliantly-coloured plumes. Standing sideways, the male draws his "cape" towards the female, dropping his wing at the same time, so that she may have an uninterrupted view of such impressive neck-livery. The polygamous and pugnacious ruff—a wading-bird about the size of a redshank—possesses a remarkably large Elizabethan ruff—hence the bird's name—which, when erected in battle, establishes a completely circular shield immediately behind the head.

ATTITUDES OF VARIOUS SMALL BIRDS DURING COURTSHIP

Display in some form or another during courtship seems to be the rule. The males of small birds, whether clad in quiet or gay colours, spread their wings and fan their tails. In the chaffinch the milk-white wing-bars are very noticeable; more so are the chrome-yellow wing-bars of the goldfinch, which flash like gold as he sways his body from side to side in a most engaging manner. Small male birds also erect the feathers of the crown during sexual excitement, and this part of the display becomes conspicuous in the blackcap, the reed-bunting, the blue titmouse, the yellow bunting, the goldcrest, and others. The wheatear spreads and erects his short black-and-white tail, rendering his milk-white rump conspicuous, and the redstart fans and flirts his tail of glowing fire. Rosy-breasted birds, notably the bullfinch, have been observed puffing out their feathers when facing the female, but we hardly think that this phase of the performance is entirely prescriptive; several species with subdued shades behave likewise when sexually stimulated.

DECORATIONS AND THE STRUGGLE FOR EXISTENCE

At this stage of our studies it is expedient to emphasize a point of supreme importance. In some birds decorative plumes reach most cumbersome dimensions; in others they are shorn of their normal architecture in a marked manner. In either case flight becomes seriously curtailed, if not completely

arrested. At first sight, this state of affairs would appear to militate against the chances of survival in the struggle for existence. But since ornamental plumes and other resplendent liveries have proved, in the long run, highly advantageous in the rôle of courtship, it may be said, of a truth, that Love is stronger than Death.

BEAUTY IN PROTECTIVE COLORATION

Beauty is largely associated with protective coloration. Birds, already well protected by the pattern and shade of their plumage, can fortify their concealment by assuming appropriate attitudes. There is something irresistibly attractive in the manner in which a baby tern or ringed plover, scampering over the sands and shingle, suddenly, on the least suspicion of danger, drops on its belly and shoots out its neck. The body and head now become two separate "stones," the slender neck being practically invisible. The woodcock, robed in a rich russet dress, pencilled with black markings, becomes almost indistinguishable when it sinks its head between its shoulders and crouches amidst withered bracken, dead leaves, and other scraps of vegetation, which carpet the woods in autumn. The bittern, when suspicious of danger, makes its body appear remarkably slim by tightening down its feathers. In directing its long beak vertically upwards so that it makes a straight line with its slender neck, the bird simulates one of the reeds or bulrushes amidst which it stands motionless as a statue. It is the strange attitude here assumed which is the chief protective factor. True, the colour of the plumage is protective to a certain extent. Some species, however, are not difficult to detect from the surrounding vegetation. For instance, the large, bold pattern and contrasted shades in black and buff of the little bittern's plumage are much easier to pick out among reeds, bulrushes, and osiers, than the mottled and vermiculated dress of the common and American bitterns. In summer, when the snow-bunting repairs to breed in northern latitudes (extending into the Arctic wilds), the plumage is, for the most part, beautifully pure white, except the middle of the back and some feathers of the wings and tail, which are black. In winter, when the bird descends to temperate climes, the purity of the white feathers becomes sullied with tawny markings, especially on the upper breast (where a narrow band is evident) and on the flanks. The head, nape, back, and shoulders also reveal the tawny shade. Occasionally, adult snow-buntings don their nuptial garb before taking their departure from the British Isles in spring.

Such individuals make a charming picture in black and white. On the other hand, there are many birds, also breeding within the Arctic circle, which exchange their dark mottled nuptial costume in winter for one that is entirely, or in a large measure, white. The willow-grouse—northern representative of the British red grouse—the sanderling, dunlin, and other wading-birds are examples. Winter-dress transformations are very beautiful; they have evolved for protective purposes—the outcome of Natural Selection.

BEAUTY THE TRIUMPHANT HALL-MARK

It cannot be gainsaid that beauty in bird-life has triumphed signally, not only in the dazzling splendour, lustre, iridescence, and exquisitely soft, velvety texture of plumage, but also in the amazing manner in which it is displayed. The prescriptive attitude assumed by the male in courtship is admittedly purposeful. True, the female may delay in response when faced with the display of ornamental plumes and other decorations. She may require repeated stimulation, but in the long run, though not without discrimination, she becomes mated. It is noteworthy that in the courtship of the Argus pheasant, the quiet, æsthetic shades of the male plumage, rather than dazzling beauty, charm the female. In many species of small birds, clad in sombre hues, beauty of deportment and song predominate in courtship. Then, again, very striking beauty pervades in plumages which subserve the purpose of protective coloration. Nay, more; we may proceed a step further, and say that assuredly in form, deportment, flight, song, family-life, and the social instincts, in addition to all those wonderful ornamentations, and their marvellous mode of display, which have engaged our attention, beauty has led a triumphant march. In fine, beauty is the hall-mark of the bird-creation.

CHAPTER V

The Triumph of Use

PRODIGIOUS APPETITES

ONE balmy morning early in August we turned up the garden-soil and collected a score of small worms, which we deposited at once on an asphalt path. We were greatly interested at the rapid rate at which these wriggling creatures disappeared. Our young robin, still wearing its juvenile dress, mottled on the breast like that of a thrush, has certainly a hearty appetite. This bird had already grown quite companionable and expectant of tit-bits which we provided every day. Hence, when it saw the pathway bestrewn with tempting little worms, it fell to and snapped them up in very rapid succession. This striking demonstration set us thinking whether after all it would be an impossible feat for a robin to demolish fourteen feet of worms *per diem*! We really thought that the consumption of even half that amount would be a remarkable achievement. However, it is undoubtedly the case that birds, as a class, have prodigious appetites. A nestling, only partly fledged, and as yet incapable of taking exercise, can eat, in twenty-four hours, food amounting to the weight of its body! An adult bird is not so insatiable; still, it has an immense appetite, and in twenty-four hours it is capable of putting away food equivalent to one-sixth of its body-weight! It seems rather quaint to think of a person weighing, say, twelve stone, eating twenty-eight pounds weight of food in a corresponding time. Worms play their part in the economy of Nature by raising and aërating the soil; however, they might become overwhelmingly numerous in some districts but for the hearty appetites of robins, blackbirds, thrushes, and many other well-known species.

DESTRUCTION OF GARDEN-PESTS

Garden-birds—taken as a class—destroy hosts of organisms which are infinitely more harmful than worms—indeed, some are downright serious pests. Not only insects fully developed, but also their mischievous grubs and caterpillars, are speedily demolished. Indefatigable energy marks such invaluable services at the period when the parents are called upon to provide for their offspring. In spring and early summer, not

only exclusively insectivorous birds, but also the granivorous house-sparrow, chaffinch, greenfinch, linnet, and bullfinch, perform the useful office of capturing multitudes of insect-pests, on which they feed their chicks. We have some interesting data in regard to the economic value of various small birds. The blue titmouse, a pigmy scarce larger than a wren, is computed to consume upwards of six and a half million insects *per annum*. Observe, a pair will rear a score of young in the nesting-season: this is a moderate estimate. When the broods leave the nests their appetites are as yet at high-water mark. Moreover, for several weeks after they have grown strong on the wing they eat about twice the amount that their parents can consume *per diem*! What, then, must be the grand total of pestilential organisms which are wiped out by this beneficent titmouse family? Obviously, the numbers must run into many millions! A great titmouse was observed conveying food—almost entirely baneful grubs—to its young so frequently during the day that, in round numbers, some ten thousand grubs were demolished in twenty days—that is to say, in the period which elapsed from the day the nestlings were hatched to the day when they first took to the wing. From personal records made on several common species, I calculated that nestlings were fed, on an average, every three or four minutes. If we lend an aid by supplying food, and if the nest be not far distant, the parents may be seen flying to and fro every other minute. Indeed, the business of catering becomes incessant until the supply comes to an end.

ECONOMIC VALUE OF INSECTIVOROUS BIRDS

The economic value of insectivorous birds is certainly remarkable. The sturdy and incessantly active little wren can make a clearance of some three million insects in the year, the capture including lurking larvæ and chrysalides, which, if allowed to develop into perfect insects, would produce countless progeny. A pair of spotted flycatchers—an abundant species in the British Isles in summer—will free our garden of some three thousand flies in a week, destructive moths and butterflies being included among the quarry. Wagtails, warblers, pipits, swifts, swallows, martins, and other common species, also levy a heavy toll in keeping down insect-pests. It cannot be emphasized too strongly that insectivorous birds (and, indeed, many others which partake of a varied diet including insects) are the most potent and economical insecticides known. The insect-world is markedly dominant;

it can be sorely aggressive; its powers can be extremely formidable. Our food-products are voraciously attacked and at times devastated. Our tissues, and those of other animals, are bitten, pierced, and even tunnelled; our blood is sucked. Birds are our unfailing, constant allies in the relentless war which we perforce wage against such pigmy foes—pigmies in size; countless in armies!

BIRDS AND FRUIT-CROPS

Doubtless, several species among our garden-birds share our taste in finding fruits highly delectable. But birds are much more catholic in their tastes, for the acrid berries of the mountain-ash, as well as those of the ivy, holly, elder, rose, hawthorn, and juniper, all of which we regard as insipid, are devoured as readily as blackberries, raspberries, gooseberries, currants, cherries, and plums. Moreover, it should be remembered that in due season birds do not partake entirely of a fruit diet, and, since they eat many kinds which we reject, their depredations are liable to be exaggerated. Undoubtedly, professional fruit-growers, who depend upon the success of their crops for a living, are fully justified in taking the necessary steps to thin out flocks of pilfering blackbirds, thrushes, starlings, and others, when they threaten to gain the whip-hand. Purely destructive measures are not invariably successful. Experience has proved in many cases that, after shooting down blackbirds or thrushes in a wholesale manner, the birds reappeared more numerously than ever, reminding us of the old adage—if we kill one fly, twenty come to the funeral! Blackbirds, thrushes, and starlings are abundant species, and their numbers are strongly reinforced by immigrants from the Continent. Therefore, extensive orchards of ripe fruit soon attract fresh invaders. Several owners of fruit-gardens are strongly of the opinion that a scaring-machine, if opportunity be granted to use it repeatedly, serves the purpose, in the long run, better than a gun. Obviously, in adopting the former measure, scores of lives are spared. Hence, larger numbers of fruit-raiding birds are allowed to carry on their useful work of destroying multitudes of noxious grubs and other pests of the horticulturist and farmer during the rest and greater part of the year.

THE MISDEEDS OF THE BULLFINCH

Admittedly, the bullfinch is destructive on fruit-buds, and, in districts where the bird is much in evidence and fruit-growing is carried out on a large scale, it is often necessary to

adopt energetic means to prevent its depredations. Here, again, we refer more particularly to horticulturists who depend upon the success of their crops for a livelihood. Yet even then the compensatory factor is by no means negligible, of which more presently. This fact should be borne in mind by all of us who are attracted by this charming bird, and who would risk the loss of at least a certain proportion of the crops, provided that finances were not materially crippled. But in small private gardens, where fruit-cultivation is maintained for family-use rather than for commercial purposes, there is little or nothing to be gained from the economic side, and very much to be regretted from the bird-lover's point of view, in shooting a pair or, more deplorable still, two or three pairs of bullfinches, directly they appear in the orchard to pay their brief annual visit in the spring. True, the fruit-trees and bushes are actively and persistently raided, but there are ways and means of holding in check the misdeeds of our picturesque visitors without forfeiting their lives. If we fire off a few blank cartridges, the birds will become scared and start flitting more rapidly from tree to tree. The application of the garden-syringe to the buds, with bitter quassia chips mixed in the water, is often very effective in keeping the pilferers on the move. Having now grown restless, they will do no material harm. On the contrary, they may prove actually instrumental in pruning or docking off a certain quota of potential fruit-buds, which, later on, might have required thinning out by the gardener. Orchards are often the better for such treatment.

THE SPIRIT OF GIVE AND TAKE

Suppose it were not possible to find time to stay in the garden and oust the pilferers from the trees, even then serious havoc would not be wrought in a well-stocked small fruit-garden. Where are the orchards in which there are not more buds than can mature and bear ripe fruit? Observe the numbers of unripe fruit which, when too thick on the trees, drop to the ground in breezy weather! When the fruit has ripened, look at the plethora of apples going to waste at the foot of the tree—apples which the bullfinch slayer is seldom at the trouble to collect. Come along to us then and welcome, happy couple: prithee spend your honeymoon amidst our apple-buds! Surely the ardent bird-lover would derive infinite pleasure in surrendering more than one basketful of apples to enjoy the company of the rosy-breasted little sinner—a strikingly handsome ornament to our gardens.

A MEASURE OF COMPENSATION

In the case of raids by several bullfinches on extensive orchards, the question of compensation must not be brushed lightly aside. Even the professional fruit-grower is reminded of some repayment, seeing that the bullfinch captures immense quantities of insects, including deleterious larvæ on which—following the habits of the sparrow and other finches—it feeds its nestlings in the early days of their existence. But that is not the only good service rendered, for when the nesting-period is over, and especially about harvest-time, the seeds of groundsel, chickweed, dock, thistle, dandelion, and other weeds, which are a nuisance to both farmer and gardener, form a substantial part of the diet. Chaffinches, greenfinches, goldfinches, linnets, sparrows, buntings, and other granivorous birds, also render excellent service in the same direction. In the light of this knowledge we have no hesitation in arriving at the conclusion that, in regard to small, well-stocked fruit-gardens, the owners receive compensation, quite sufficient to dissuade them from systematically shooting the beautiful bullfinch at first sight—often a merciless act of injustice committed through want of discrimination.

ECONOMIC VALUE OF BIRDS-OF-PREY

Let us now consider the part which predatory birds play in the economy of Nature. At the outset it may be said that their ruthless destruction is, and always has been, an act of sheer folly. On the whole, the depredations upon game are adequately counterbalanced by the check which birds-of-prey so efficiently put upon the rapid multiplication of small mammals (mainly rodents), and of birds and insects injurious to crops. Even rabbits—notwithstanding the fact that they are consumed in enormous numbers by Man himself—are far too numerous in some districts, and consequently require to be kept well in hand. In former times, the larger birds-of-prey came to the rescue, but they have been so persistently persecuted that at the present day they are far from common in the British Isles. It has been observed that the physique of some species of wild-fowl—to wit, the grouse and wood-pigeon, among others—has shown signs of deterioration in certain areas which have been over-stocked, and the birds allowed to become too numerous. Indeed, disease has been known to become rife, a state of affairs which was far less noticeable when birds-of-prey were more to the front. In a large measure these splendid birds were friends,

not enemies, of the gamekeeper, who, notwithstanding, has been mainly responsible for their depletion in numbers. The keen ornithologist greatly deplores the disappearance of birds-of-prey from the British Isles. Nowadays the superb flight and other equally fascinating habits of predatory birds offer little opportunity for study.

HOW THE SPARROW-HAWK ASSISTS THE FARMER

Beyond all doubt it is a mistaken policy to wage relentless war on the sparrow-hawk, which preys almost exclusively on small birds, including several species injurious to crops. It is sufficient to keep a check on its piratical tendencies should they prove troublesome. All sparrow-hawks do not make a practice of plundering the farm-yard or game-preserve, or of snatching at linnets and goldfinches in cages. In the harvest-season we can well afford to leave this nimble hunter to its own devices when we meet it in the open, remote from the farm-yard. When left unnoticed it will do good service by "policing" the corn-stooks! Very likely it will be content to make the fields and hedgerows its happy hunting-ground at the time when the grain is ripening. Its sudden dash at incredible speed, every three or four hours, through large flocks of pilfering finches, has decidedly a deterrent effect. True, the bird-of-prey may capture and devour only three or four victims in the day, but its repeated visits to the corn-stooks prevent the farmer from losing several sacks of corn in the season. It has been stated that a sparrow-hawk, by merely scaring finches and buntings from ripe grain, saves the wages of ten boys! It is true that chicks are snatched up from time to time. Such accidents would scarcely take place if fowls were adequately protected with a fence. Surely the poultry-rearer takes undue risks in permitting baby-broods to scamper about fields, ditches, and hedgerows, outside the bounds of the farm-yard.

THE BENEFICIAL SERVICES OF THE KESTREL

The kestrel is the most numerous and the most widely distributed of the hawks indigenous to the British Isles. It cannot be mistaken for any other bird-of-prey, on account of the unique way in which it poises in the air head to wind, when hunting for its prey. It has been called aptly the "Wind-hover." Thus engaged, its wings vibrate at such a rapid rate that the individual strokes can hardly be distinguished. This charming little falcon appears as though suspended by

an invisible thread : a motionless figure on outstretched wings. The kestrel merits strict protection. Small birds are usually unconcerned about its presence ; they are rarely molested ; and, as a rule, chicks receive little attention. However, should a kestrel commit an occasional petty larceny—an irresistible pounce on a stray baby-pheasant or partridge—it may be freely forgiven, because it is to the agriculturist a signal benefactor, by keeping in check immense numbers of mice, voles, and young rats, as well as beetles and other harmful insects. Some years ago I had occasion to examine the stomachs of two hundred kestrels ; twelve only contained the remains of small birds, and five of these belonged to kestrels which were shot in the breeding-season, when the extra task of providing the nestlings with food had to be faced.

THE OWLS' HEAVY TOLL OF RATS AND MICE

At twilight, when the kestrel has withdrawn from the hunt, the barn-owl, the tawny-owl, the long-eared owl, the little owl, and in the winter the short-eared owl—all active hunters—appear on the scene. Raids are renewed, and continued during the hours of darkness. Mice are captured in by far the greatest numbers ; but scores of rats, some quite full grown, also fall victims. No wonder that the late Lord Lilford once made the telling remark that the man who shot an owl deserved to be accommodated in a lunatic asylum ! It has been estimated that rats destroy about £70,000,000 worth of foodstuffs in the British Isles *per annum* ! Surely it is a very short-sighted policy to interfere with owls whose valuable services are carried out in the silent hours of darkness.

DEPREDACTIONS OF THE LITTLE OWL

It should be mentioned, however, that no species of owl can be entirely acquitted of killing birds. The little owl is at times an intrepid depredator. Blackbirds, thrushes, and other birds of the bush are snatched from their roosting-places. The downy chicks of game and other precocious nestlings are pounced upon in broad daylight. This pigmy plunderer occasionally enters a rabbit-burrow and hauls out a baby-rabbit ! I am here reminded of an occasion when I surprised a little owl at quite close quarters. It was in a field surrounded by high embankments. The quaint little pirate stood over its prostrate prey. Seeing me it rose, and, holding on tenaciously to its booty, it headed straight for a rabbit-hole, down which it instantly disappeared ! Presumably the bird anticipated the impossibility of clearing

the embankment with its heavy burden. Hence its cunning tactics. The quarry was a young rabbit—a hefty load for a miniature bird-of-prey to carry off, even for a short distance. On the whole, the percentage of birds captured by owls is low, so that even the little owl (despite its manifold raids and wide choice) is still afforded time to perform an incalculable service—in conjunction with its much larger congeners—in clearing away hosts of cockchafers and other insect-pests. In some districts voles swarm until they become virtually a plague. Owls, if not molested, help materially to ease the situation, and the tiller of the soil reaps the benefit.

ABUNDANCE OF BIRDS-OF-PREY IN THE ORIENT

In the Orient birds-of-prey, and also crows, are free from persecution to a large extent. This is a sound policy, seeing that there are many species—in addition to those which take their quarry alive—which devour vast quantities of offal, and in that direction are most useful scavengers, and triumphantly beneficial to Man, especially in the Tropics. I was more than charmed with the graceful and adroit aerial movements of large numbers of kites, buzzards, eagles, and vultures, which I had the opportunity of observing at Aden, Colombo, Bombay, and other Eastern Ports. Quite a number of crows—intermediate in size between our British rook and jackdaw—freely fraternized with the birds-of-prey. These crows were certainly most entertaining, and I recall to mind two or three especially perky birds, who, bold to a degree, swooped down, bounced forwards, and, in a twinkle, snatched food from our hands. A crow accepted a small slice of buttered bread, which it dropped almost immediately in its hurry to get off; a second bird instantly snatched up the tit-bit. Nothing daunted, the first bird stalked over to our tea-table and solicited another slice, which it took from my hand with an air of assurance! Kites, in goodly numbers, anticipated our kind intentions, and approached before the food was exhibited. They brushed gracefully past us and back again, seizing in the air pieces of meat cast at close range. Several of these splendid birds when poised on outstretched wings, devoured their food. It was fascinating to see the manner in which they curved their heads beneath their breasts, to enable them to tear off in rapid succession pieces from the lump of meat grasped in their talons. Many years ago kites were numerous about London, especially along the estuary of the Thames. But they have long since vanished; indeed, they have almost disappeared *in toto* from the British Isles. Even in the quietude of rural

districts, buzzards and harriers now rank among the rarer species. Eagles are afforded rigid protection in deer-forests and wild fastnesses of the Highlands, where they breed and are holding their own. Elsewhere in the British Isles they only occur from time to time as casual vagrants. We trust that the protection now afforded the rarer British birds-of-prey will prove instrumental in permitting them to hold their own against unlawful attacks on themselves and their progeny. Predatory animals are "the salt of the earth." They have proved themselves beneficial in the economy of Nature, and this is the passport for their protection. Their lives should be respected.

DANGERS OF DISTURBING THE BALANCE OF NATURE

We should bear in mind that it is a risky business to interfere with the balance of Nature. It is very difficult, sometimes impossible, to readjust the wheels in Nature's workshop when they have been put out of gear. Life weaves on the loom of time an exquisitely fine, delicate web, and its warp and woof must not be ruthlessly torn. In many instances, where beneficent birds have been harassed, or, still more deplorable, have been ruthlessly destroyed—as we have seen has been the case in regard to birds-of-prey—their places have been taken by insurgents, which have carried in their wake over-population and disease. Man has bitterly repented before now of his folly; he has yearned to restore those highly cherished, useful birds, which he has been instrumental in exterminating; alas, never to return!

BIRDS TRIUMPHANTLY USEFUL TO MAN AND OTHER CREATURES

Truly, then, it may be said that birds, as a class, are signal benefactors to Man: not only to Man individually, but to the community as a whole. Birds, in a large measure, come to our rescue in keeping up food-supplies, more particularly in regard to our home-grown crops. Before Man *was*, birds had already proved themselves triumphantly useful to their fellow-creatures. Millions of years ago birds were busily engaged in consuming astounding numbers of baneful insects, destructive rodents, and other animals; all pestiferous to a terrific extent, if permitted to go unchecked. We have seen that birds have also proved themselves triumphantly useful to Man himself at the present day. Let him therefore act discreetly: let him study diligently Nature's ways and laws of promoting economy, and thereby of maintaining a proper balance.

CHAPTER VI

The Triumph of Vision

A HEADLONG PLUNGE

AFTER a long tramp we dropped into the heather for a rest. We had now climbed far above the precipitous cliff-face, tenanted by vast multitudes of vociferous sea-fowl. Very few moments elapsed before a peregrine came from out the clouds—a speck floating in the blue expanse. Scanning the earth below, the far-sighted falcon suddenly espied its quarry from a height whence it would have been impossible to discern it by the human eye. Hurling itself downwards like a thunderbolt, it struck its victim with unerring aim, and bore it away in the clutch of its sharp and powerful talons. This glimpse of falconry in wild Nature held us spell-bound ! From a height of one hundred feet or more, numerous gannets, far away over the sea, were dropping like white boulders into the waves, in pursuit of their finny prey. Here was another impressive spectacle ! Terns—charming birds of lesser size—embodiments of buoyancy and grace, of a sudden stayed their flight and, like pearly arrow-heads, shot down in rapid succession among the multitudes of sand-coloured shrimps which lay half buried in the floor of the shallow lagoon. The propeller of our steam-launch churned the water into a seething foam. Into this briny wilderness we cast pieces of bread, which immediately disappeared from view. But the keen-sighted gulls astern lost not a moment in swooping down and instantly demolishing the booty, snatched from out the hissing “cauldron.”

ON THE WING AT TOPMOST SPEED

Swallows, martins, and swifts, cleaving the air at topmost speed—now up, now down, now turning and twisting sharply—snap up diminutive insects by the score in amazingly rapid succession. A humming-bird darts past, but its speed is so high that we almost fail to recognize the form of a bird. Yet in a flash, “in the twinkling of an eye,” the tiny creature pulls up dead, and alights daintily upon the slender, swaying spray ! Can we always recognize the form of the kingfisher, darting like an arrow down the stream ? We are reminded of a huge sapphire scintillating in the summer sunshine ! A sparrow-hawk, coursing round the bend of a country-road, grabs a

chaffinch, almost at our feet. A shadow : a squeak : no more ! All vanished in an instant ! Some dark object dived under the belly of a sheep, whence it carried off a starling. But the intrepid little merlin became recognizable only when, burdened with its quarry, it had perforce to slacken its speed on the wing.

A DASH THROUGH THICKET

It is astonishing how so many different kinds of birds, flying at topmost speed, manage to get clear of dense thicket and reach the open, without touching an obstacle. We try to follow the path pursued by a jay, a woodcock, or a turtle-dove, dashing through a timbered glade, to elude observation. Almost instantly we are defeated in our endeavours. We are fully aware that foliage and other cover intercept our view to a considerable extent, but the main difficulty is due to the tremendous speed at which the bird travels through cover.

FOCUSsing ADJUSTMENT IN RAPID FLIGHT

What have we learned from these delightful observations ? In the first place, that the faculty of visual accommodation—in other words, the faculty of adjusting the focus of sight—has been carried to a surprisingly high degree of development. The mechanism herein involved allows of more intricate and extensive movements of the parts of the eyeball concerned than are found in other vertebrate animals. This focussing adjustment reacts so rapidly that, for all practical purposes, it is instantaneous. In swift flight many objects enter the focal field, only to become blurred in an instant were the bird unable to change its visual accommodation with lightning speed ! Behold the soaring eagle and falcon ! Aloft, when reconnoitring, they are far-sighted in a marked degree ; at the finish of the downward plunge they have become markedly short-sighted. Hence these hunters, from start to finish—a period of time almost too fleeting to register—have been enabled to keep their quarry clearly in view. This marvellous power of visual accommodation with which birds are endowed is correlated intimately with their marvellous velocity and adroitness on the wing.

KEEN AND PENETRATING VISION

In the second place, we learn that birds are gifted with extremely keen and penetrating vision, thereby enabling them to detect inconspicuous objects—often at a considerable distance—and to pick up food under circumstances which at times seem to us almost incredible. A green-fly—that tiny pest, a few millimetres in length—appears to a titmouse at twenty

yards distance, several times larger than it appears to Man, who, indeed, would hardly see it at all. The charming little kestrel can identify a mouse or a grasshopper ensconced in thick grasses or other herbage when, high in the clear blue sky, the bird-of-prey appears to us only the size of a sparrow ! The peregrine falcon, in full open chase, is sometimes compelled to drive its quarry upwards until both become lost to view in the clouds. Unsuccessful in this project, the hunter ear-marks another bird far below. With wings almost closed, down goes the falcon, headlong like a meteor ; kills its victim and hurls it to the ground with a single stroke, as though it were pierced to the heart by an arrow shot from a bow !

HOW BATS ON THE WING AVOID OBSTACLES

Bats, flying rapidly, twist and turn, and yet are exceedingly adroit in avoiding obstacles, not only out of doors at dusk, but also in a well-furnished and artificially illuminated room ; yet these animals are almost blind ! But, since their sense of Touch is so highly-developed, they can appreciate, through disturbances in the air, a feeling of resistance reflected, as it were, from near objects, which incites them to sheer off before making actual contact. Here, finely-attuned tactile sensibility has largely supplanted the sense of Sight ; consequently the latter has become markedly recessive. Bats, in chasing their insect-prey and performing other vital functions, depend almost entirely upon their keenly-developed sense of Touch, aided by their extremely acute sense of Sound. On the other hand, the senses of Taste and of Smell come much less into play, and the sense of Vision takes a back seat.

VISION AND EMOTIONALISM

It is otherwise with birds. Apart from the utmost use which they make of their keen eyes when seeking food on the wing, in the water, in trees, or on the ground, they also bring, in a most emphatic way, their highly-developed visual sense to bear upon most activities concerned in courtship. Let us follow, step by step, this interesting association. Temperamentally, birds are brimming over with life. Anyone who has studied them closely, both as captives and in the wild, is well acquainted with their exuberance of spirits. Their vivacity is bound up with bubbling emotions. It is the rule, rather than the exception, for small birds to be emphatically loquacious. These features manifest themselves in a very marked manner during the nuptial season : at that period birds are surprisingly amorous and excitable. Undoubtedly, their ardent love-antics, dances, display of plumage and of other ornamenta-

tions, and also their passionate outbursts of song, are all intimately correlated with tremendously high vitality. These traits reach the highest pitch of development in our familiar garden-birds. In this direction, therefore, we are granted every facility for study. We need not go beyond our homely friend the house-sparrow, awaiting our offerings at the door-step, to satisfy ourselves in regard to evidence of avian loquacity. Chirping, chattering conversation-notes, made up of quite a liberal selection of different phrases, varying in pitch, tone, and rhythm, may be heard during many hours of the day in suburban gardens. Titmice are also veritable little chatter-boxes ! When on the defensive, they start scolding on the least pretext in harsh, aggressive accents !

PROBLEMS PERTAINING TO THE PSYCHOLOGY OF COURTSHIP

There still remains a more fundamental reason than high vitality to explain not only the above-mentioned remarkable tokens of emotionalism, but also several problems pertaining to the psychology of courtship. We desire to know how it has come about that mating is so prolonged and elaborate; why it is that the male is so very pleasingly subtle and seductive (his polite behaviour standing out in contrast to the ruder and rougher mannerisms so characteristic in the courtship of mammals); why it is that love-making is charmingly æsthetic and coy in many instances; how it is that the female apparently has become endowed, though in varying degrees, with some notion or another of a taste for the bright and beautiful, and with the faculty of appreciating variations in colour; and, lastly, whence has she derived that faculty of discrimination which so strongly prompts her to select a particular male from amongst several competitors. With a view of throwing light upon these problems, we must in the first place consider the relative values that can be assigned to all the physical senses besides Vision.

THE SENSES OF TOUCH AND TASTE

Touch and Taste are senses not strongly developed in birds. In Man the finger-tips show marked tactile sensibility; in birds the fingers—in being transformed into part of the framework of the wings—have become, for the most part, fused together, and the sense of Touch has become blunted. The feet are usually ensheathed in horny substance; likewise the beak, and neither is particularly sensitive. There are some birds, however, whose long, slender beaks are wrapped in a softer covering, into which the cutaneous nerves can penetrate

and take up finely-attuned impressions of Touch. The snipe, woodcock, and many species of "sandpipers," in plunging their long beaks into soft estuarine ooze or bog-land mire, can immediately determine the presence of wriggling worms and other moving creatures, upon which they so largely feed. The tongue of birds, in its more typical form, is narrow, flat, and pointed. It may be short like an arrow-head, or long like a spear. It is usually horny, and its tip is almost insensible to pain, in that way resembling the free edges of the nails. As a gustatory organ it seems rather feebly-developed. In song-birds, its rapid vibratory movements may perform the office of an accessory reed, in addition to the main vibrating semi-lunar membrane situated in the syrinx. But the chief function of the tongue in birds appears to be manipulatory. We must have noticed the skilful manner in which the parrot triturates its food between tongue and palate. In this bird, in the duck, and in some other species, the tongue is bulky and fleshy, and, to a certain extent, sensitive to touch. Here Taste is also better developed than in birds with thin, horny tongues; nevertheless in all birds it remains a recessive rather than a dominant Sense.

FASTIDIOUS PALATES

In watching birds feeding, we cannot fail to notice that some are at times fastidious in regard to what they eat. In captivity or in sanctuaries, where there is a plethora of food, a bird may grow faddy, like a spoilt child, about its food. But if the rations be cut down, hunger once more becomes a good sauce! Discrimination in regard to food is quite another matter. Wild birds have a keen intuitive knowledge (largely helped through their discriminating powers of vision) in regard to what is wholesome and what must be rigidly avoided. Certain birds whose flesh and fat have a pungent odour are not immune from the grip of the hawk! A hungry bird-of-prey will not refuse the flesh of any animal. A peregrine falcon plucks and devours a fishy-flavoured kittiwake or puffin with as much relish as a grouse. A merlin, shot in the act of devouring a storm-petrel, recently came into my possession; the remains of the victim also were forwarded. Many of us are aware that the flesh of the storm-petrel has a strong, pungent smell, while the fatty tissues, and especially the oil (in which the bird is bathed), give forth almost an overpowering effluvia!

THE SENSE OF SMELL AND A "SCENT-TRAIL"

Once upon a time the sense of Smell in birds was thought to

be very acute. Vultures sniffed carrion from afar. The wary curlew, by smelling gunpowder, often outwitted the fowler. These ideas are fallacious. A captive vulture took no notice of a parcel of putrefying meat presented for its inspection. It was not until a hole was made in the paper and the contents were well exposed that the hungry scavenger tore the wrapper to pieces and devoured the carrion. I have deposited my gun and have scattered several empty cartridges, smelling pungently of powder, on marshes where curlews were feeding. When I sought ambush, and the birds returned, I watched them foraging unconcernedly, though from time to time they inspected the fowling-piece with curiosity. Indeed, in birds, as a class, the sense of Smell is but feebly-developed. That is why Taste (as we have seen) follows suit. Physiologically the two senses are inter-dependent. Taste and Smell are temporarily paralysed in many persons when attacked by severe nasal catarrh. It appears obvious that the sense of Smell grew retrogressive because a "scent-trail" could not be maintained with efficiency during flight. Odours would become swiftly diffused, and soon become lost altogether in air-currents. Therefore, the male bird, in his endeavours to woo his mate, must set out in the first instance to entice her rather than to pursue her to a standstill, the latter procedure being adopted by mammals. The significant value of the quality and power of the voice now becomes manifest. Musical sounds—and these are uttered by a large number of species—carry a long distance; hence the coy female stays her flight, plucks up courage, and listens attentively to the amorous song of the males. Presently she advances, and, not without some semblance of deliberation, mates with the favourite vocalist.

THE SENSE OF HEARING AND VOCAL RESPONSE

The sense of hearing is quite keen, but, in picking up subdued sounds at a distance, such as a soft footstep or the rustle of a leaf, birds are less sensitive than those mammals which are provided with large and freely movable ears—for instance, rabbits, hares, and others. Yet the power of focussing instantaneously the exact spot whence the sound emanates is remarkably developed in birds. One day I heard a redshank piping on the opposite beach of a small island. Rising ground intercepted a view of the bird. I crouched low under the shadow of a rock, and commenced to imitate the wild, mellow, musical call-note. Instantly the redshank rose and flew towards my place of ambush. I continued to whistle; the bird replied. Of a sudden, it swooped down, and alighted almost at my feet!

It was not until I moved and betrayed my presence that my piping companion, now astonished beyond measure at my proximity, became exceedingly alarmed, and, in a twinkle, beat a hasty retreat. A bird, owing to its accurate judgment of the source of a sound, can, on hearing call-notes at night, readily locate its companions, though they may be too far distant to be seen. In this way, hosts of migrating birds are kept in touch by the loud cries of their leaders. The rear-guard follows the vanguard by means of vocal response. It now becomes evident that the sense of Hearing possesses a peculiar value in its application to courtship; a value which proves decidedly advantageous, because it is quite possible for the mating-birds at the outset to become keenly responsive, even when screened from one another by dense foliage.

THE SENSE OF VISION AND COURTSHIP

However, all further advances—to wit love-antics, dances, and display of adornments—demand for their ultimate success uninterrupted visual impressions. It is the sense of Vision which strikes the dominant note, above all others, in the ceremonial of courtship. Birds are not only gifted with singularly keen and penetrating vision, rapidly adjustable for the clear focus of near and distant objects; but, what is much more remarkable, they are also gifted with keen perception of form, and with the faculty of appreciating colour. Indubitably, birds quickly learn to discriminate between various objects, affording evidence that they are close and, in a certain measure, critical observers. In truth, their other physical senses pale before this astonishing development of Vision.

THE PREDOMINANT "EYE-BRAIN"

Sight may be regarded as the mainstay of the bird's brain; the sheet-anchor of its life! From the psychical, no less than from the physiological, standpoint, the bird is endowed with a decidedly predominating "eye-brain," as assuredly as a dog is endowed with a decidedly predominating "nose-brain." In searching for food, whether the movements be local or protracted; in competing with rivals for territorial rights in the courting-season; in endeavouring to thwart the enemy; and in discharging many other daily duties, birds make use of their eyes to the utmost, and practically all day long. We watch how eagerly they take stock of strange objects, close at hand, in the distance, in the open firmament, or on the ground. Resting or flying, they are often called upon to view their surroundings in wide-spread perspective.

KEY TO THE PSYCHOLOGY OF COURTSHIP

Consequently, birds must surely become visually impressed in a marked degree, with form and colour in diversified objects, and with the lights and shades of earth, sky, and sea. Is it any wonder, then, that birds when courting exhibit an aesthetic sense, giving us to understand that they are stimulated by, and derive pleasure from, bright and beautiful ornamentations? Again we desire to ask: Is it any wonder that passionate love-antics, dances, and gorgeous display of decorative plumes and other strikingly attractive adornments of the male, should stimulate the visual sense and fully excite the "eye-brain" of the female, in urging her to bring into action her powers of discrimination before making the final choice of a mate—the closing scene in the long act of courtship? Surely it would be unreasonable to presuppose that the extraordinarily predominating psychological features which love and courtship portray in the life of the bird are other than those closely correlated with a brilliant, and in every way highly-perfected, *Visual Sense*. This correlation is all the more striking when we consider the case of species, clad in gorgeous robes, yet bereft of the charm of melody; because here it follows that the Auditory sense is but slightly called into play, consequently the sense of Vision exercises almost the sole prerogative throughout the rôle of courtship.

RETENTIVE VISUAL MEMORY

Birds have a retentive memory for places which they have had occasion to visit in search of food or for other purposes. Some species are remarkably astute in remembering instantly the very spot where they had hidden—frequently buried—oddments of foodstuffs for future consumption! Magpies, jackdaws, and crows, will return, after an absence of several hours, and exhume their buried booty with remarkable perspicacity. In regard to migration, it is evident that instinct alone cannot offer a satisfactory explanation of the manner in which the travellers reach their respective destinations. We have already learned that birds are gifted with amazingly keen perception of form—a factor in Vision which, when translated by a dominant "eye-brain," must surely allow of the projection of a clear and tenacious mental picture of the contour of mountain-ranges, the course of river-sheds, and many other striking geographical features lying along the migration-routes. There are cogent reasons for supporting the view that migrants are guided in no small measure by landmarks. For, if such

beacons be occluded by fog, hosts of travellers lose their way. In clear weather birds can exercise their long range of vision, and in that way bring additional aid to bear upon their peregrinations. Multitudes of migrants journey along the seaboard of vast Continents, taking their bearings from time to time. Beyond doubt, the sense of Vision in birds must prove itself triumphant where protracted migrations, fraught with dangers and difficulties, are undertaken.

IMAGINATIVE FACULTY

Birds are wont to take definite likes and dislikes, of which several instances already have been cited. Here may be added a curious case in which the Imaginative faculty is revealed and called into action. One of my tame kestrels was always very much attached to me, provided that I did not put on a hard, black felt-hat. If I approached wearing this head-gear, the bird grew alarmed and instantly retreated. Probably it conjured up in its mind the form of some object which it had previously seen and, for some good reason or another, had strongly disliked. This little falcon loved the dog, and jumped on its back, or even on the crown of its head, whenever a black cat, to whom it had a strong objection, put in an appearance. Here again we have striking evidence of the discriminating powers of avian vision.

AN EXQUISITE OPTICAL INSTRUMENT

Turning our attention for a moment to the eye of the bird, regarded technically as an optical instrument, we find that it is a superb piece of apparatus; truly a triumphant sense-organ. We have already learned that focussing for near and distant objects can be instantly adjusted when the bird is travelling at topmost speed through the air. The thin transparent membrane which forms the front-window—the cornea—of the eyeball is remarkably convex in birds. It is significant that the convexity of this cornea can be altered to a very appreciable extent. At death it completely collapses. By altering the curvature of this “front-window” the mechanism of focussing by means of the lens is largely supplemented. This is part of the mechanism which allows an instantaneous “change of hands” between long and short sight during extremely fast flight. We know that in the eye of all vertebrates, including birds, focussing for near and distant objects is brought about by altering the curvature of the lens *in situ*. In the eye of the bird, the lens itself can move backwards and forwards in a slight

degree, in association with the lengthening and shortening from back to front of the entire eyeball, brought about by alterations, as above described, in the curvature of the cornea.

VISION A FAR-REACHING TRIUMPH

A brief summary of the leading facts in the text clearly indicates that the sense of Vision leads the way triumphantly. The whole life of the bird is controlled, swayed, and permeated, by visual impressions. A large area of the brain presides over visual activities. This overshadowing "eye-brain" reveals itself in charming psychological manifestations, redolent of æstheticism, subtlety, beauty, and lyric: these and other qualities figure prominently in courtship, and provide a fascinating line of study. We may go a stage further, and say that the study of avian mentality throughout is most fascinating. But, physiologically speaking, where would the bird be without its pair of exquisite optical instruments? Clear, powerful, adjustable lenses, and other refractive media, are necessary for the purpose of focussing clearly and accurately the images which they form of external visual impressions—images which are translated in the visual area of the brain. In making a headlong plunge, where would the falcon be were it not provided with such exquisite optical endowment? Likewise, the titmouse could not focus finely on the green-fly; the swallow could not snatch up the flying-gnat; the song-thrush could not spy out the wriggling worm. Deprive the birds—our staunch allies—of their brilliant vision, and a world of swarming insects, and other dreadful pests, would gain the ascendancy, making human life intolerable. Human community, as now constituted, could not live without birds, and birds would die out if the lustre of their eyes were dimmed. Surely for Man and his fellow-creatures, no less than for the birds themselves, *Avian Vision* marks one of the most triumphant milestones in the history of Evolution.

WHEN THE CURTAIN FALLS

There is something markedly pathetic about the expression of a dying bird. From time to time the under lids are gently raised and lowered. The "windows of the soul," lustrous to the last, are alternately opened and closed. When at last the "silver cord" of life is severed, the under lids, rising to their fullest extent, meet the upper and shorter components. Then the "blinds" are fully drawn: the "curtain" falls. Figuratively, it is true that birds "fall asleep" in death.

